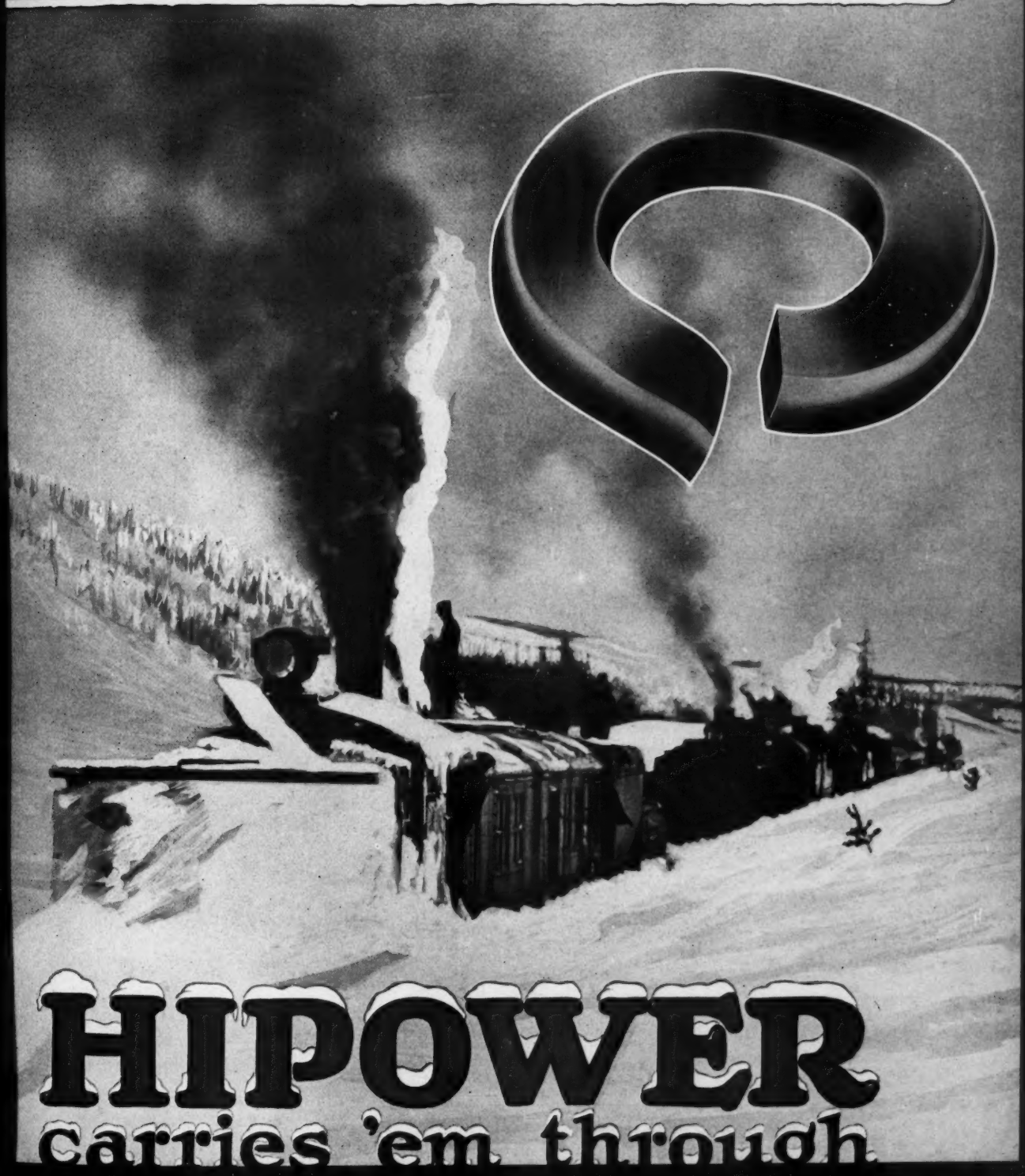
FEBRUARY, 1924

Railway Engineering and Maintenance



RELIANCE HY-CROME NUT LOCKS

BUYING nut lock protection for rail joints is no longer an unwarranted assumption or guess.

The protective efficiency of every Reliance Hy-Crome Nut Lock is definitely assured.

Hy-Crome, possessing the highest degree of "Spring" exerts a greater reactive pressure against the nut, minimizing the possibility of working loose.

The better resistance against extreme vibration at rail joints—fewer adjustments, and most of all, the saving of inconvenience and traffic delays are the correlated features that constitute the hundred per cent value railroads can buy when specifying Hy-Crome.

THE RELIANCE MFG. CO., Massillon, Ohio

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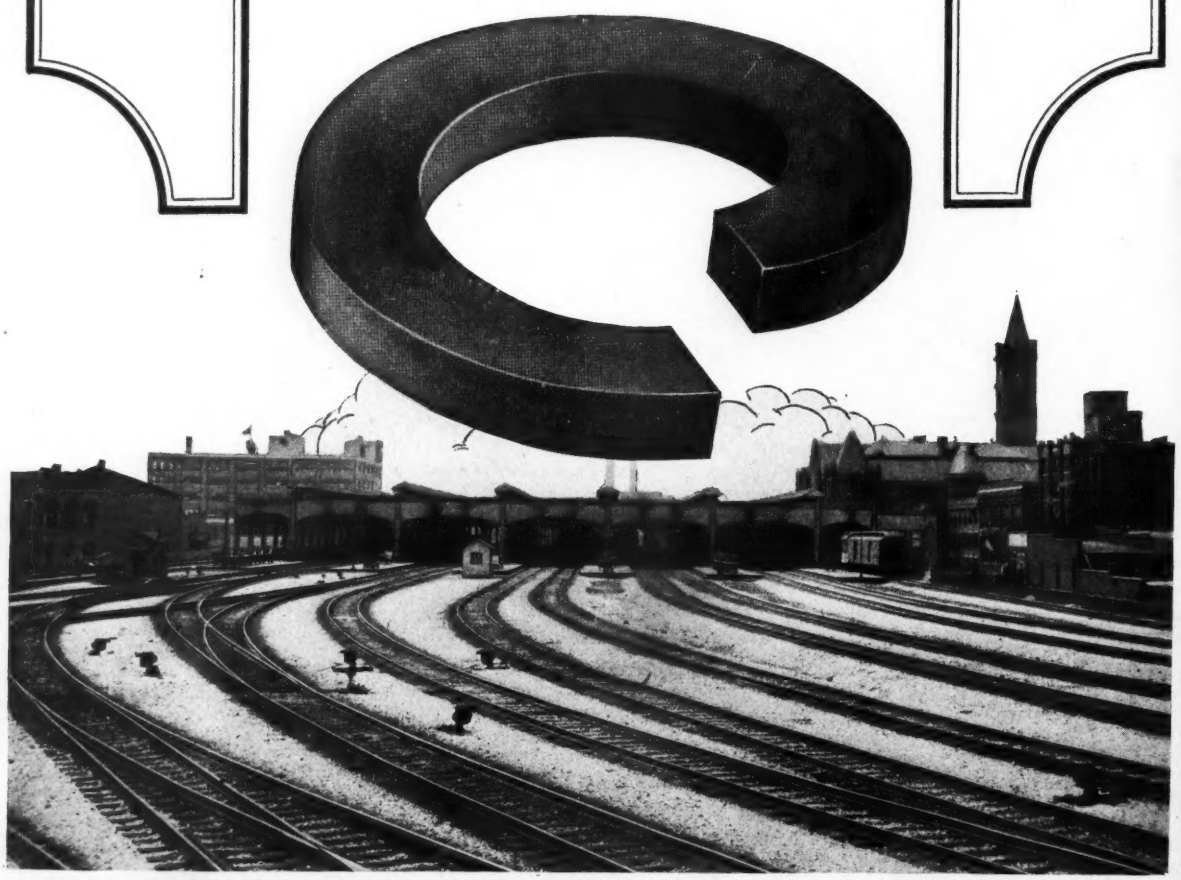

RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisements, Page 34 Classified Index to Advertisers, Pages 32 and 34

Gang Efficiency
demands the "All-Service" Car
(A Mudge Product)

THAT, after all is what you really want—efficiency in track work. Motor cars are track tools and should be so regarded.

Therefore, they must be simple, rugged, easy to understand and built to stand up under both ordinary and unusual conditions.

Such a car is the **Mudge** "All-Service" class "WS-1"—roomy enough to seat ten men, powerful enough to handle extra gang work, light enough for a small gang and equipped with the **Mudge** eight horse power, *roller bearing* motor with the **Mudge** *aluminum* hopper.

Furnish this car to your men and be sure of satisfactory and economical service.

Catalogue on Request

Note the Patented Lifting Seat Top—an exclusive MUDGE feature

The Mudge
CLASS "WS-1"
"All-Service"
8 H. P. Motor Car

Mudge & Company
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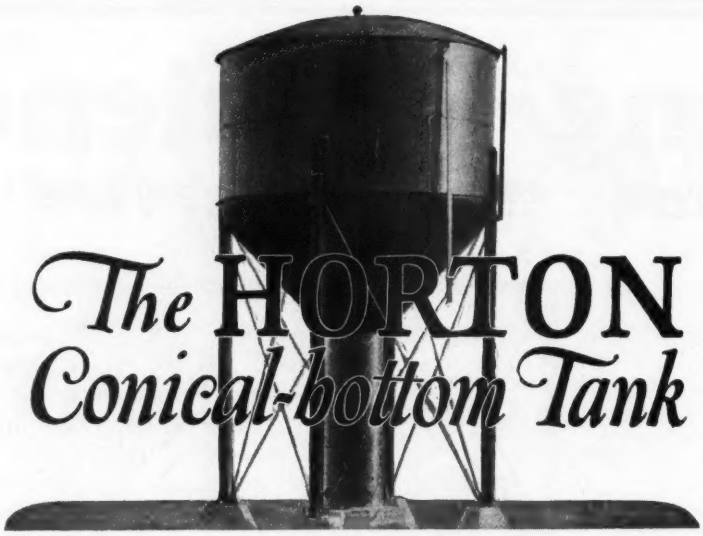
Railway Exchange Bldg. • CHICAGO



The HORTON Conical-bottom Tank

Standardize *on the* Tank that Does 3 Things

THERE never was a tank to rely on like the Horton conical-bottom. Why? Because it has a canny knack of being useful almost anywhere. Primarily, it is used for water treatment, water settling and roadside delivery.

In these three uses it has no equal. No other design will meet the exacting requirements of railroad maintenance engineers. In popular parlance, the Horton conical-bottom "delivers the goods."

For Removal of Suspended Matter

Horton conical-bottoms have lately been used successfully to remove finely divided matter in suspension in water for railroad boilers. The Yazoo and Mississippi Valley Railroad has installed these conical-bottoms for the sole purpose of removing the suspended matter encountered in water at Baton Rouge, Louisiana. Scale-forming solids were almost entirely absent, and the conical-bottom tank was chosen as the best means of settling out the suspended matter. The ease of sludge removal was an important factor in the selection.

The conical-bottom made this water entirely satisfactory for boiler use. The installation needs little care, for it functions entirely by the sure force of gravity.

For the Softening System

Where scale-forming solids are found in the water supply, softening becomes necessary to get best results. Our engineers have worked out Horton conical-bottom installations which are proving to railroad men the superiority of this tank in water treatment. The advantage of using the conical-bottom is that there is no dead water space—the entire volume of the tank is used and all the water is thoroughly treated. Excessive sludge is easily removed. Timed opening of the wash-out valve retains just enough suspended matter to make the reaction of the treating thorough. The cost of sludge removal is less than in most other systems.

(*Note:—Do not confuse the Horton* ***conical-bottom*** *with the old unscientific cone-bottom.*)

For Roadside Delivery Service

Because they last indefinitely, because they do not leak, because they are not affected by the climate or the weather, because they cannot burn, rot or fail from other causes, and because they require no maintenance except painting every three or four years, Horton *all-steel* elevated tanks provide a long-run economy which more than one hundred leading railroads are taking advantage of.

Installation of a Horton conical-bottom *steel* tank for roadside delivery purposes relieves the railroad official from worry, because we assume responsibility for materials and workmanship. The steel tank is cheapest in the end; the conical-bottom steel tank gives the best service during its long life.

Chicago Bridge & Iron Works

251 CHICAGO 2452 Old Colony Bldg. DALLAS 1646 Praetorian Bldg. SAN FRANCISCO 1007 Rialto Bldg. NEW YORK 3156 Hudson Terminal Bldg. ATLANTA 1036 Healey Bldg.

Relocation on the Frisco Eliminates an Old Tunnel.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 20 February, 1924 Number 2

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WOULD YOU LIKE TO KNOW

Two ways of cleaning water pipe?

What tie producers say about market conditions?

How to operate a steam hammer under water?

The effect of mixing oil with creosote?

What the Japanese earthquake did to the railroads?

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NEW ORLEANS: 927 Canal Street

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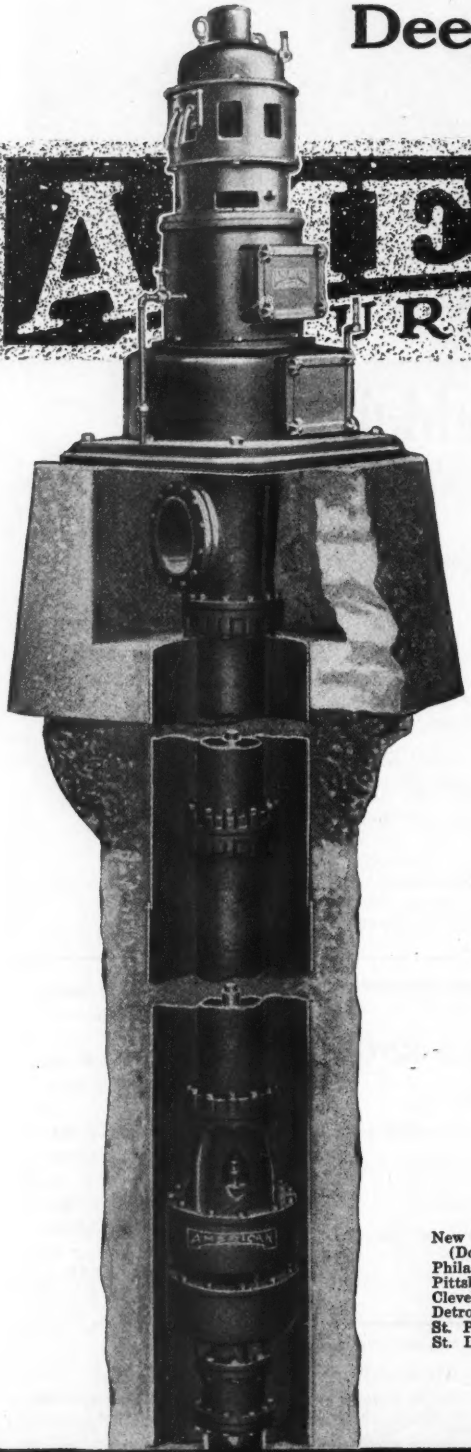
Subscription price in the United States, Canada and Mexico $2.00 per year; foreign countries $3.00. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34, Victoria Street, S. W. 1) in £-s-d.

Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)

Announcing the "American" Totally Enclosed Deep Well Turbine Head!

AMERICAN
AURORA, ILL.



Totally enclosed, this new motor driven head has great rigidity of construction, and counteracts any vibration from moving parts in the turbine.

It is equipped with Kingsbury water cooled thrust bearing, and provision is made for complete drainage of all waste oils and water. The discharge in this new design is located below ground, which makes for an unusually compact and neat installation.

Easy access is had through two openings to the interior of the head.

Literature describing this new head is available; ask for it!

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General Office and Works
AURORA, ILL.

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FIRST NATIONAL BANK BLDG

ARMCO Culverts in Railway Service

No. 3 of a Series

Name of Railway: M. St. P. & S. Ste. M. R. R. (Soo Line).

Location: Main line, Minneapolis to Chicago.

Traffic: Heavier than average, passenger and freight.

Installation Data: Two 12 ga. 48 in. ARMCO Culverts, single riveted. Fill, about 4 ft. of sand. Installed in 1910.

Condition: Slight settlement of joint has caused little elevation at both intake and outlet. Otherwise in excellent condition. Photographed and inspected April 15, 1922.

Remarks: Double riveting is now specified for this type of installation. Also, in sand, or soils of low bearing value, it is recommended that pipe be installed on a camber to allow for settlement under concentrated load of fill and traffic. In some cases, a foundation of gravel or crushed stone is indicated.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested

Ingot Iron

ARMCO CULVERT & FLUME MFRS. ASS'N, 215 North Michigan Avenue, Chicago

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DAVIS
APPARATUS
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"Anything and Everything for Oxyacetylene Welding and Cutting"

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Air Reduction Sales Company maintains its own Apparatus Repair Shop in each Airco District Office City.

"Airco Oxygen and Acetylene Service is Good Service"

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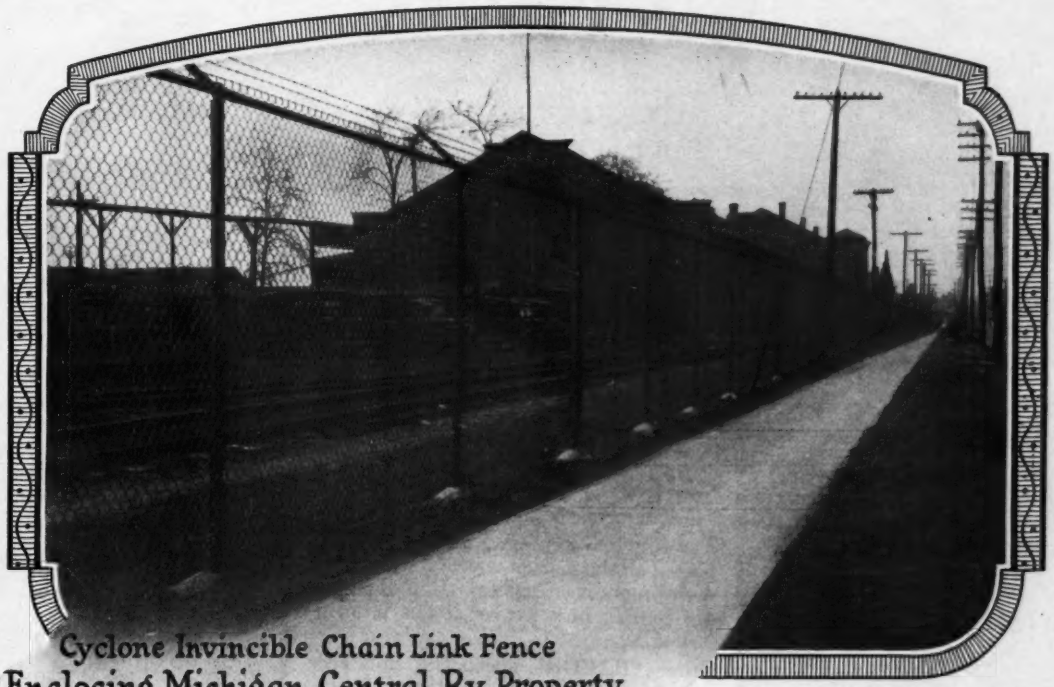

Cyclone Invincible Chain Link Fence
Enclosing Michigan Central Ry. Property
Detroit, Mich.

Years Longer Service Without Annual Maintenance

The economy of fencing railroad property is recognized by the country's largest railroad systems. Cyclone Fence prevents damage and destruction to property by vandals; stops trespassing; reduces danger of accidents; reduces cost of property upkeep.

And, the soundness of using Cyclone Galv-After Chain Link Fence is recognized as equally important. For this means fence will last years longer without annual upkeep expense. The first cost is the last. There is no expensive painting annually, etc.

Cyclone has been able to produce this new, rust resisting fence through the perfection of a new process in fence manufacture—Heavily, Hot-Dip, Zinc-Coating (or Hot-Galvanizing) Chain Link Fence Fabric AFTER Weaving.

Write nearest offices, Dept. 39, for complete information about this better fence and Cyclone Service, which solves any fencing problem.

Cyclone Fence is built in either wire or iron for shops, inter-track, right-of ways, parks, etc., a fence for every purpose. Estimates rendered promptly. If desired, the Cyclone Fence Company will furnish, at reasonable charge, expert construction superintendent to supervise installation of fence, or, will assume complete responsibility for the proper installation of fence.

Cyclone "Red Tag" FENCE AND PRODUCTS

The Mark of Quality Fence and Service

CYCLONE FENCE COMPANY

Factories and Offices:
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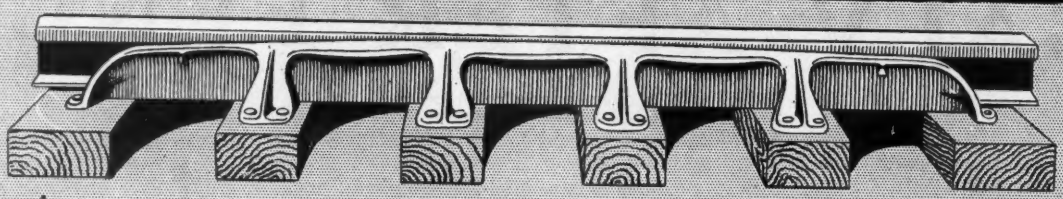
Oakland, Cal. (Standard Fence Co.) Portland, Ore. (Northwest Fence & Wire Works)

Cyclone Fence

PROPERTY PROTECTION PAYS



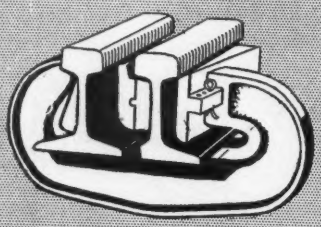
AJAX MANGANESE STEEL
ONE-PIECE GUARD RAIL

Ramapo and **Ajax** specialties have been long and favorably known under their individual names as manufactured by Ramapo Iron Works and Ajax Forge Company. These two companies are now consolidated into Ramapo Ajax Corporation, with five completely equipped works conveniently located for prompt deliveries to the railroads of the country. To assure service in the Western territory a stock of Ramapo Automatic Safety Switch Stands is carried at the Chicago headquarters.

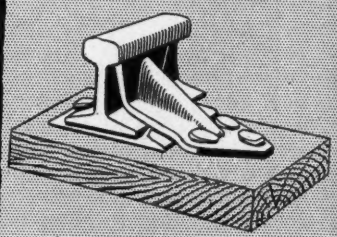
The Ramapo improved No. 20-B stand, placed on the market a year ago, has met with pronounced success. Repeat orders are coming in wherever it has been installed.

Other "RACOR" specialties not here illustrated include Switches, Frogs, Crossings, etc., Special Railway Track Work, Cast and Rolled Manganese Rail Construction, etc.

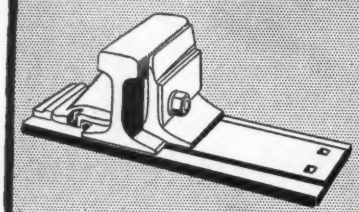
Particular attention is directed to the Ajax One-Piece Guard Rail at top of this page. Its combined simplicity and rigidity make this the most efficient and economical installation.



RACOR FORGED
HEAVY DUTY
GUARD RAIL CLAMP

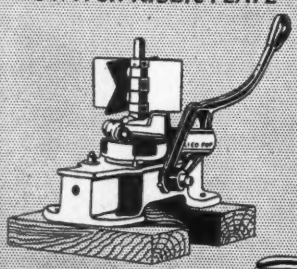


RACOR
FORGED RAIL BRACE

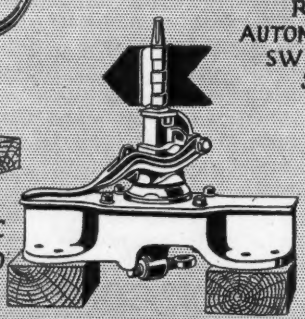


RACOR DOUBLE SHOULDER
SOLID BOTTOM
SWITCH RISER PLATE

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No. 17



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No. 20-B



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No. 19

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SWITCH STAND
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Creosoted Poles
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A half century of experience in timber preser vation is at your service.

Let Choice *Not Chance*

Govern Your Tie Purchases

If you postpone your tie purchases until the last minute:

If you delay until late in the spring when the demand for ties is at its height:

If you wait until active competition in the woods puts prices up and quality down:

If you do these things you are taking a chance. But—

If you contract ***now*** and let International choose your ties, you not only save time and expense in securing them, but you receive the best assurance of tie quality.

Every International tie is sound, full size, carefully graded, and produced far in advance of use to receive proper air seasoning. Our insurance of quality is driven into every tie in the form of our International Dating Nail.

DON'T WAIT—International is ready and at your service.

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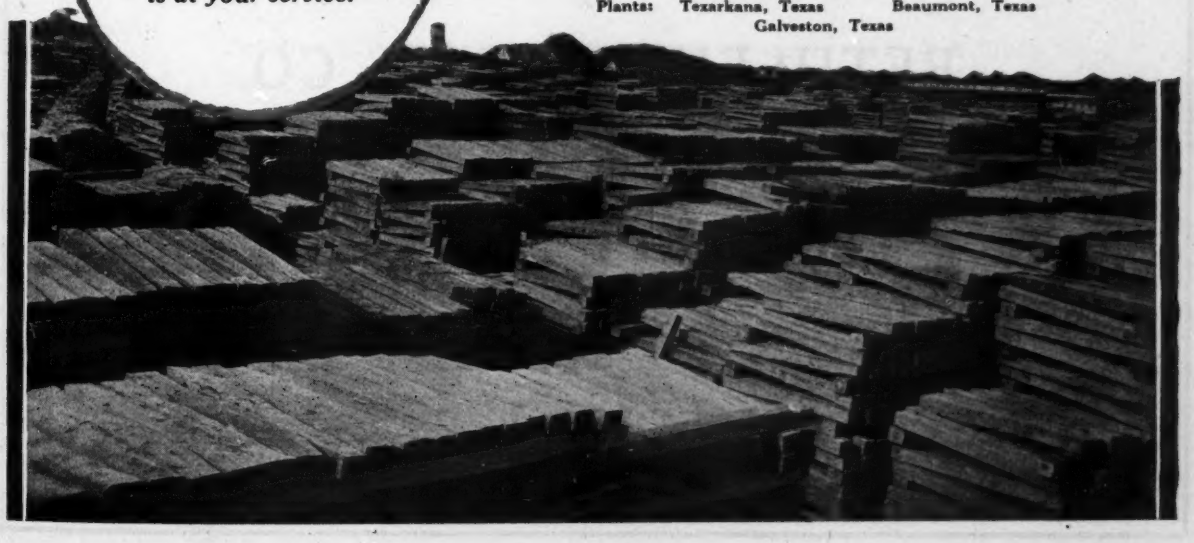


Selflock Track Bolts

Save on every mile

"Selflock" track bolts are a complete track fastening. When using "Selflocks" you buy shorter bolts and no locking device. In applying "Selflocks" there is nothing to adjust, fix, or break. Over any combination requiring a locking device, "Selflocks" show a considerable saving on every mile of track.

Regularly furnished on the highest grade of Heat Treated steel, "Selflock" track bolts are an absolute guarantee against bolt stretching and loose joints.

Write for descriptive literature.

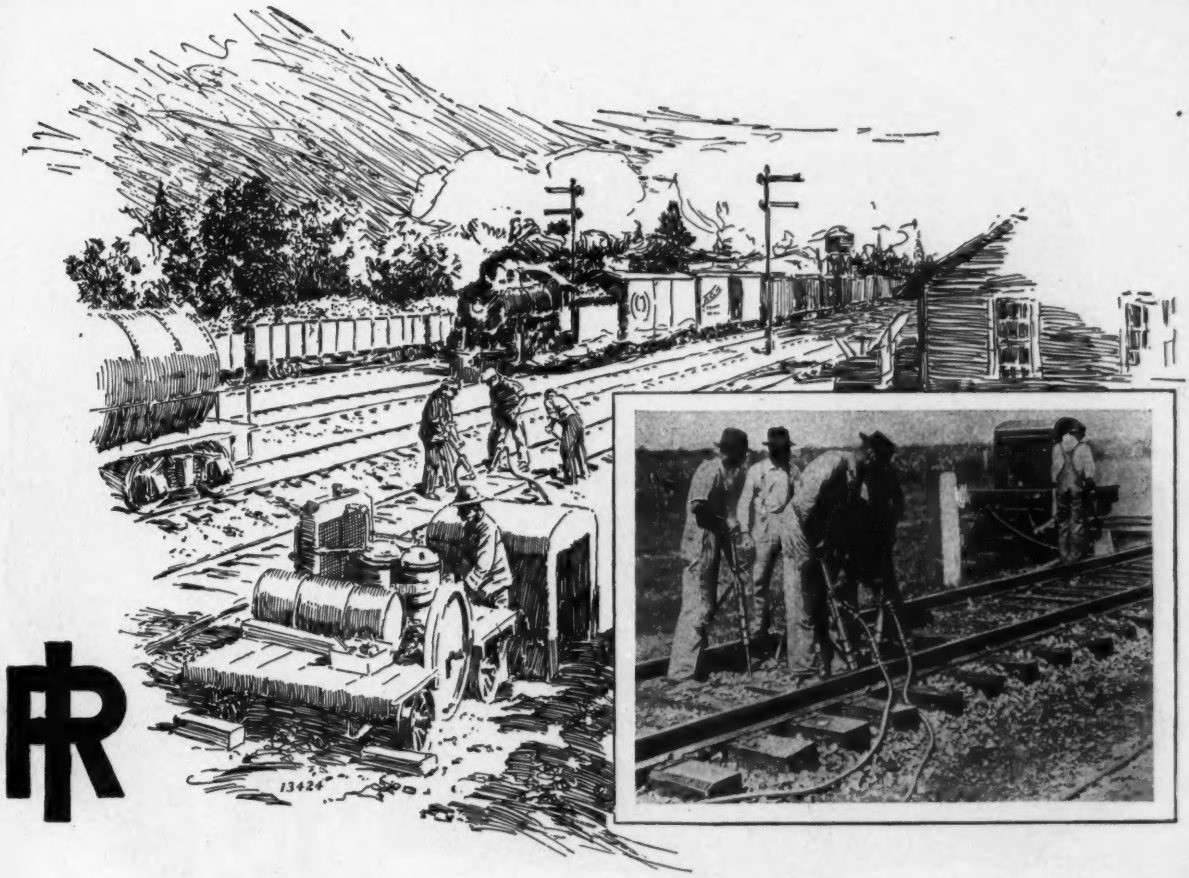
Selflock Nut & Bolt Co., Inc.
East Syracuse, N. Y.

OR

BETHLEHEM STEEL CO.
BETHLEHEM, PA.

SELFLOCK

Track Bolts — Machine Bolts — Crossing Bolts



NEW STANDARDS IN TRACK EFFICIENCY

Pneumatic Tie Tampers, first of all, tamp the track so that it stands up two to three times as long as hand tamped track. The track is also more uniform and smoother.

The better track is obtained with less labor and in less time. Four men with Pneumatic Tampers will tamp more track in a day and do a better job than sixteen men with ordinary picks and bars.

Better track, that lasts much longer, produced with less labor and in less time and with a resulting saving in the final costs, is the reason for the adoption of Pneumatic Tampers as the standard equipment for hundreds of track maintenance gangs.

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Offices in all Principal Domestic and Foreign Cities

For Canada refer Canadian Ingersoll-Rand Co., Limited, 260 St. James St., Montreal, Quebec

173TT

Ingersoll-Rand

Loading one of the bore holes for the big Frazier blast.

Blasting 250,000 tons of stone

A record quarry shot in the South with du Pont dynamite

WHEN the Chesapeake & Ohio Railroad needs ballast they start a young earthquake and shake down a hill to get it.

In what is believed to be the largest quarry shot ever made in the South, a quarter of a million tons of stone recently were thrown down and well broken at the Frazier Ballast Quarries, Frazier, West Virginia.

Fifty-eight thousand pounds of du Pont explosives were used on the job—42,000 pounds of 60% Gelatin and about 16,000 pounds of Red Cross Extra 40%. Cordeau Bickford was used throughout as a detonator with trunk line connection. Including explosives and labor, this shot cost nearly $30,000.

The blast consisted of 71 well-drilled holes varying in depth from 30 feet to 157 feet. The holes were spaced 16 feet apart and set back from the face of the quarry on an average of 24 feet.

J. R. Anderson, of the C.&O. Road, was superintendent of operation and S. R. Russell, of the Technical Section of the du Pont Company, directed the loading and firing of the shot.

E. I. DU PONT DE NEMOURS & CO., Inc., Wilmington, Delaware

Explosives Department

Du Pont Products Exhibit, Atlantic City, N. J.

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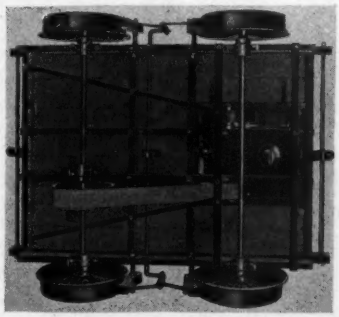
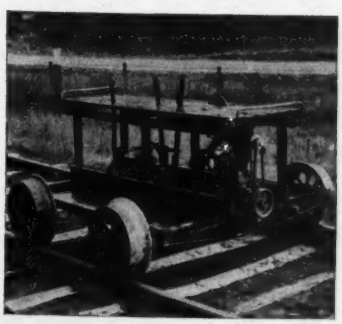
Showing portability of Casey Jones, Hyatt equipped, standard section motor car No. 520.

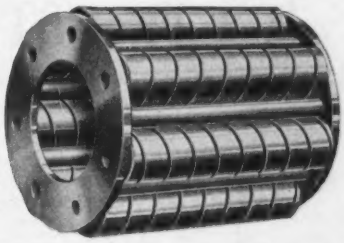


Bottom of above car No. 520 showing drive and location of five Hyatt roller bearings.

Casey Jones heavy duty car No. 550. Has Ford engine and Hyatt bearings.



Hyatt bearings also on this Casey Jones inspection motor car No. 535. These cars are all manufactured by the Northwestesn Motor Co., Eau Claire, Wis.



Casey Jones Standardizes On Hyatt Roller Bearings

The Northwestern Motor Company, Eau Claire, Wis., in producing its high grade and economical Casey Jones railway service cars, has standardized on Hyatt roller bearings.

These cars are real fuel and power savers due largely to the fact that the Hyatt bearings alone reduce the power requirement over 50% on level tracks.

Lower lubrication cost is another important feature of Hyatt bearing cars. They require lubricant only three or four times a year which results in less oil or grease used and far less lubricating labor than required by plain bearing cars.

Hyatt bearings once installed are there to last the life of the car, without replacement or adjustment. Bearings taken down after years of service under all conditions fail to show noticeable wear.

Add to these advantages, easy starting, smooth running, and general carefree operation and you have an idea of what Hyatt bearing equipped service cars mean.

Don't be handicapped by plain bearing equipment. Dispose of your service car troubles by specifying Hyatt roller bearings.

Hyatt bearings can also be had for heavy equipment, both electric and steam. Write for complete information.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER MILWAUKEE HUNTINGTON
MINNEAPOLIS PHILADELPHIA CLEVELAND
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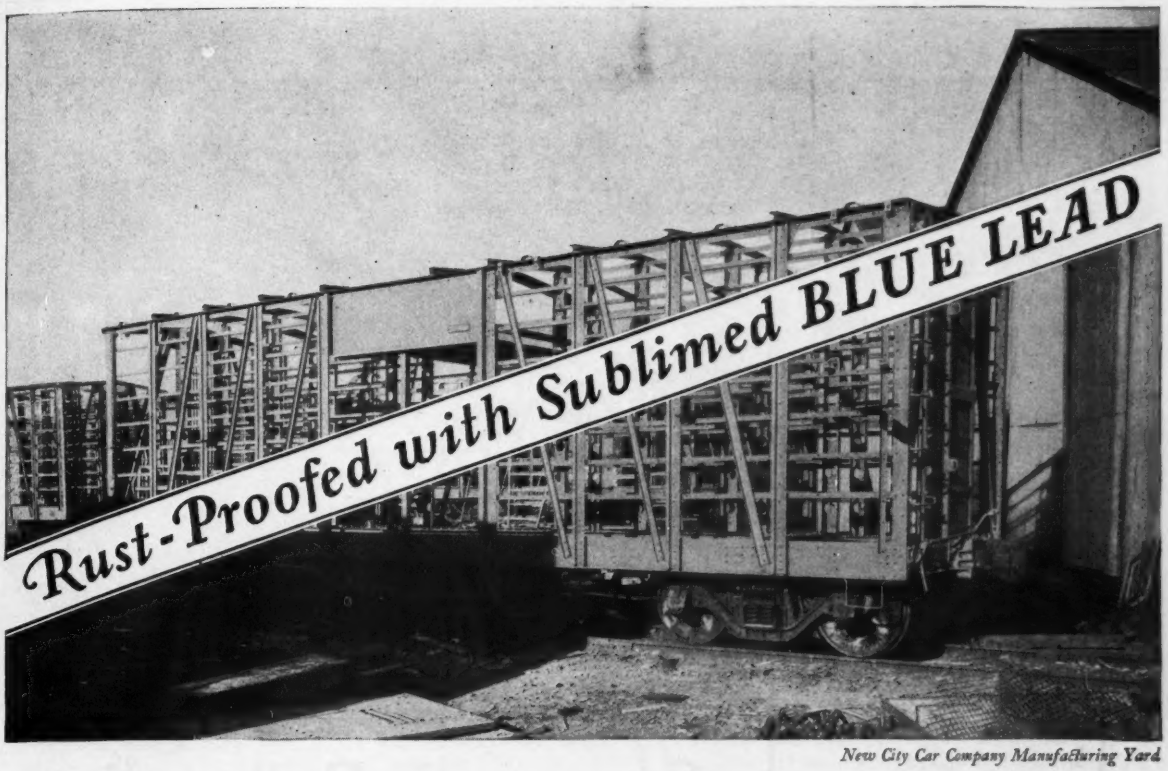

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Railway Engineering and Maintenance

Volume 20 February, 1924 No. 2

THE REDUCED WINTER FORCE

HOW many track men can be worked to advantage in the winter time? The answer to this question is almost sure to disclose differences in the points of view of the management and the subordinate officers. It is natural for the supervisor of track to present every argument he can bring to bear in opposition to the drastic curtailment of his organization. He realizes only too well that the reduction in force will require him to lay off some energetic wide-awake young men who will not return to him in the spring. He knows, also, that any day may bring a storm which will call for the employment of all of the men he can find.

That, of course, is only one side of the story. When the ballast is frozen solid little real track work can be done, while with temperatures much below zero the men can accomplish little even if there is plenty of work to do. In other words, if the roadmaster will be honest with himself he must admit little useful work is done by the winter track forces outside of the emergencies that come with storms.

The situation, therefore, is one that calls for a balance between considerations influenced by the relative permanence of employment and the economy of a minimum force during a period where few men are required. The problem deserves greater study now than ever before, because of the scarcity of the class of men who make the most desirable track laborers and section foremen; the work must be made as attractive as possible for the steady, responsible workman. One suggestion for holding more men in the ranks during the winter is to spread the allotted man hours of work over a larger number of men by a shortening of the working day or a system of layoffs on certain specified days or days of bad weather.

But as it is perhaps not practicable to employ many more men in the section gangs during the winter season than is now the custom there is a possibility of reducing the annual cut in force by employing less men in the gangs during the active season. This may be accomplished by doing more work with extra gangs and by lengthening out the active season—beginning it early and closing it late. This measure would have the added influence on the problem of the cut in force, since the prospect of but a short layoff would lead many men to hold themselves in readiness for re-employment.

RELATIVE EFFICIENCIES

For every 100 tons of freight transported in 1900, the railways of the United States transported 234 tons in 1920. Each ton was hauled an average of 242 miles in 1900 and 304 miles in 1920. Because of these facts the number of revenue tons transported one mile in 1920 was equal to 292 per cent of that carried two decades earlier. The number of passengers carried one mile increased in the same ratio.

The amount of capital invested in the railroads in 1920 was 193 per cent of that invested in 1900, while the number of employees in 1920 was 199 per cent of the number engaged two decades earlier. The relative output of the railways per unit of investment was therefore 292 per cent, as compared with 138 per cent in agriculture, 228 per cent in manufacturing and 231 per cent in mines. Equally marked is the comparison of the increase in the output per person employed, the production of the railways in 1920 as contrasted with that in 1900 being 147 per cent, as compared with 133 per cent for agriculture, 110 per cent for manufactures and 136 per cent for mines. Thus, the railways lead the three other leading basic industries in the efficiency of utilization of both labor and investment.—*From data compiled by the Research Council of the National Transportation Institute and made public on January 21.*

THE WAY TO AVOID A LABOR SHORTAGE

WHILE this year promises to equal 1923 in the amount of money the roads will spend for improvements and to exceed last season in the work to be done on the tracks and structures, less thought is being given to the prospects of a labor shortage than at this time a year ago. This cannot be attributed to a decline in the activity of other industries or in any great addition to the supply of labor. Rather it is the result of the dissipation of the spectre of a labor shortage which threatened last spring, for the condition which threatened to curtail work to a large degree failed to materialize. This should not be interpreted as an indication that the danger was not a real one. On the contrary, it is an evidence of the success of the efforts which the roads made to counteract it by starting their work as early as possible in the spring and by utilizing their labor to the best advantage by supplementing it with mechanical equipment. Faced with a program of a magnitude which exceeded their ability to complete it by ordinary methods, railroad officers started their work earlier than usual in the spring and were thereby able to finish a large part of it before other demands of a seasonal character developed. As a result, the threatened shortage was overcome and cases of actual inability to secure the required number of men was limited in number.

With a program equally large this year engineering and maintenance of way officers cannot afford to allow

themselves to be lulled into a false sense of security by the experience of last year, but they should repeat and strengthen the measures which proved effective then, not only to insure the completion of their programs, but also because this contributes to the economical prosecution of the work. It has been demonstrated that those steps which contribute to the full utilization of labor add to its efficiency and productivity. Not only do those employers who enter the market first secure the best men, but once employed a large portion of these men tend to remain throughout the season. These men also work more efficiently during the spring, both because of the more favorable climatic conditions and because of the absence of demoralization which is inevitable when the demand for labor exceeds the supply.

Another influence which is becoming more marked each year and the effect of which was instrumental in no small measure in warding off a labor shortage last year was the use of mechanical equipment. The greatest stimulus to the development and adoption of such equipment is, of course, the inability to complete work without it through shortage of forces. However, such equipment also almost invariably reduces the cost of work if properly applied so that it is entitled to consideration whether the supply of labor is ample or not. The installation of equipment which will increase the productivity of men is an essential step in the development of every industry. The railways have led the world in the efficiency of their operations because of the development of the heavy train load which is a means of increasing the amount of transportation produced per man employed. It is inevitable that the maintenance of way department must develop and adopt labor saving equipment more generally and the efficiency with which its operations will be conducted will vary almost directly with the progress which is made in this direction. Therefore, whether the labor supply is short or ample this year, engineering and maintenance officers should foster the more extensive use of this equipment, both by co-operating in the development of that which is still in the experimental stage and by utilizing that which has passed the development stage and has proved its practicability. It is through developments such as this that the railways will be able to overcome the effects of a shortage when it develops, for it is a rule of industry that shortages do occur at periodic intervals.

The railways have the power in their own hands in large measure to determine whether there will be a labor shortage this coming spring. They can avoid it largely, if not entirely, by arranging their work so as to reduce to the minimum the number of men which they will require by supplementing their efforts with mechanical equipment and by using those required to the best advantage. Now is the time to prepare.

PUT ON THE FINISHING TOUCHES

IT IS generally conceded that the tracks on most railroads in this country are now in a better state of repair than at any time in the last six years. This fact reflects credit on the management and on those men directly responsible for the active maintenance work. But to obtain this end in full measure, the fact that the roads are in good condition must be recognized by the general public, which, in the main, derives its information about the railroads while riding on trains, visiting railroad stations or crossing tracks at highways.

Necessarily, the opinions formed by the layman are superficial, being founded on observations of only the most obvious features, which reflect the physical condition. The effectiveness of drainage and the condition of the ballast, ties and rails are necessarily matters concerning which the passenger obtains little knowledge except when the net result of these as affecting line and surface, produces good riding track or what the passenger calls "a good roadbed." On the other hand, well policed track, a well marked ballast line, freedom from weeds and a properly mowed right-of-way are certain to produce a favorable impression.

Another feature that is sure to be observed is the condition of the roadway signs as seen from the back of a train or where highways cross the track. Signs painted neatly and at sufficiently frequent intervals to insure that the colors retain most of their original freshness add a finishing touch to a railway property which will produce a favorable impression and carry out the thought that the road is well cared for.

THE PROBLEM OF INCRUSTED WATER LINES

WHY pipe lines that have gone for years without causing trouble should acquire the choking habit as soon as a treating plant is installed on the river end of the line is not so much the object of this discussion as the fact that they do manifest such a habit. It is not asserted that trouble of this sort occurs wherever water is treated or that it occurs only where water is treated. But it is true that the tendency for pipe lines to stick up, lime up, scale up, gum up, incrust or clog up (call it what you will), when carrying treated water is sufficiently prevalent on practically every road where water treatment is undertaken to offer an attractive outlet for man's ingenuity in meeting the problem. As a result, the problem of removing the incrustation and of again rendering serviceable, expensive and important lines which immediately prior to cleaning were anything but serviceable, has been mastered so well that railroads need have no fears concerning the practicability of and the profit in such work. This is borne out by an article elsewhere in this issue where two roads undertook pipe cleaning work, each according to its own fashion, and each apparently with good results.

But is pipe cleaning the way to get at the incrusting problem? Is the remedy for the trouble experienced each year from the accumulation of foreign matter in pipe lines, and also in storage tanks, the mere designing of such appurtenances as to afford ready cleaning and the development of effective methods of cleaning in the event of clogging? When pipe lines become clogged and storage tank capacities are seriously encroached upon by sludge, obviously the recourse is to remove the accumulations. But it is a sad commentary upon water treatment processes if that is the only recourse, and, notwithstanding the proficiency with which such work is done, the value of water treatment to railroads must ever be greatly impaired and its progress greatly hindered as a result.

Fortunately, cleaning is not the only way to attack the incrusting problem, neither is it the best way. Rather the solution lies in preventing incrustation and after-precipitation. Because this has not been prevented in all cases does not prove that it cannot be prevented. It is no more logical to say that incrusted pipe lines and turbidity in treated water are unavoidable accompaniments of water treatment than to assert that freeze-ups are the unavoidable accompaniments of cold weather. The reason why so much cleaning of pipe lines is done or is to be done on railroads is not difficult of ascertainment. Too many treating plants are built which are imperfectly suited to the work they are called upon to perform. There are also too many well designed treating plants which have suffered from inattention and careless handling. Again, there are too many evidences of a

lack of application of genuine scientific effort to study the local problem and remove the imperfections, for which it must be said that the officers in immediate charge are not always to blame. Pipe cleaning is less of a necessary accompaniment of water treatment or a reflection upon water treatment as a process than it is a reflection upon our present methods. Is it not inconsistent with our ideas of progress that after 20 years of water treatment on railroads the same trouble should be experienced with incrusted pipe lines and unsettled water today that was experienced when the first water treating facilities were introduced?

To meet the problem of incrustation and after-precipitation, therefore, is to meet it at its source, to develop water treatment to the point where there will be no occasion for it, and engineers engaged in water treatment may well apply themselves to this end.

REMOVAL OR PREVENTION

AT this season of the year when one of the chief problems of roadway maintenance in a large part of the United States and Canada is that of keeping the line open in the face of drifting snow, it is well to give thought to the permanent as well as the immediate remedy. It has been said that the best plan of snow drift removal is snow drift prevention. In other words, the same rule applies here that is advocated in other phases of maintenance work, namely, that the best solution of a problem is the adoption of that remedy which will make its recurrence improbable.

In certain respects, drifting snow is similar to water in its action. Snow and rain will fall but the results of their fall can be controlled. It was formerly a regular occurrence for many bridges to go out during each flood, but the waterway openings have been increased, structures made more secure and other measures adopted which have transferred this form of interruption to traffic from the annual to the unusual. Some progress has also been made in the control of snow, but much yet remains to be done. Snow drifts according to well defined laws. Because of this fact drifts can be controlled largely at will. The proper design and location of snow fences, wind breaks and other forms of protection will do much to direct the snow to points where it will interfere least with train operation. It may now be too late to adopt other than the most simple expedients to protect against this winter's storms, but the location, extent and source of the trouble encountered this winter may well be studied and made a matter of detailed record so that proper steps to prevent a recurrence of the difficulty may be developed at leisure and then put into effect to afford relief next year. It is commendable to meet these attacks successfully when they come. It is a better practice to prevent their occurrence. Now is the time to initiate such a program.

The Walls of the Union Pacific Station at Riverside, Cal., Are Finished in Stucco

Letters to the Editor

BETTER BOARDING CAR CONDITIONS ARE NECESSARY

Milford, Conn.

To the Editor:

A subject which is becoming of vital interest to the railroads is the furnishing and boarding of laborers for extra gangs. The money that the railroads lose in the course of a year in hauling laborers from the labor centers is tremendous, for the majority of the men shipped do not go for the work, but for the ride or to get to another city.

There are labor shipping offices in every large city that make a practice of getting a boarding contract or a labor shipping contract with some boarding contractor who boards the men at some distance from New York City, for instance. These offices will ship the men to the vicinity of Buffalo, Pittsburgh or Cleveland for a cash labor fee of from $4 to $10 each, and will tell the men, "You can go to any of the above places—get a couple of meals—and beat it."

The fee paid by the laborer is split between the shipping and boarding contractors, and they both make money, while the railroad companies lose money, for they pay the boarding contractors payroll, furnish all the equipment with which to operate the boarding houses and also furnish the transportation free to the men. Yet railway officers wonder why they never have any men in their extra gangs. If they have a camp that holds 100 men, one reason why they are lucky to have 25 men in it is because the two contractors can make more money by shipping the men for the cash labor fees than they can by boarding them.

There are labor offices all over New York City and the other cities mentioned, which are conducted by foreigners, some of whom can hardly speak the American language. The boarding contractor is frequently also of the same class. It is time that railway officers wake up to the fact that the padrone system is at the bottom of their troubles.

A contractor can make money and still feed the men well but he can make more money by not having men in the camp, that is, by shipping them, as the profit on each man shipped is clear, and often ten times what he can make by boarding them.

Then again there is the question of sleeping quarters If they were kept clean, which is not the case, and the beds made daily, there would be no complaint. If some of these outfits were visited and the men who live in them questioned, the conditions would often be found worse than stated here. Better still, go along the old Bowery in New York City and ask the men how they are taken care of in the different padrones outfits shipping out of any of our Eastern cities. There are companies that are in the boarding business, that feed the men and that have no trouble in getting laborers to go to camps they operate, because the men know they will be fed well, their camp cars kept clean, the beds made every day and the cars fumigated. As laborers become scarcer there will be less men to do the work with. The remedy lies in cutting out the thorn that hurts, the old time padrone system. Make the boarding contractor operate his own employment offices in large cities near his different jobs instead of shipping men 300 to 1,000 miles, who never intend to go to work.

T. GILLISPIE.

Properly Constructed Highway Crossings Add a Finishing Touch to a Well-Maintained Property.

Keeping Down Maintenance Costs at Highway Crossings

Two Papers Which Point to the Need of Higher Standards and Report Results Secured Through Improved Construction

IT is an odd coincidence that the most recent meetings of both the Metropolitan Track Supervisor's Club of New York and the Maintenance of Way Club of Chicago were devoted to discussions of the highway crossing and the measures being taken to provide standards of construction which more nearly meet the requirements of present day traffic on the highways. In the case of the Metropolitan club this matter was presented in the form of a report of a committee composed of nine maintenance of way officers, while in the case of the Maintenance of Way club it was presented as a paper by the engineer maintenance of way of an important interurban line which has for some time pursued the policy of providing the best possible construction in the crossings of its line with many important highways. Both the committee report and the paper are presented in abstract below:

North Shore Maintains Electric Crossings to a High Standard*

By J. S. HYATT

Engineer Maintenance of Way, Chicago, North Shore & Milwaukee, Highwood, Ill.

Every member of this club has seen the transition from the horse drawn vehicle to the automobile and knows that this change has made the highway crossing a much more important factor in good railway maintenance. In the days of the horse and buggy, a few planks, some boat-spikes and a section-hand made a highway crossing. The unevenness that resulted from rough cut timber and careless work made little difference to the vehicular travel because it was slow moving. But with the day of the automobile has come an era of universal speed. Everyone is trying to see if he cannot get there first; and the little bumps, in spite of cushions and pneumatic tires, have, by the very impact of this speed, been increased to defects of the first magnitude. True, the overstrained nerves of the automobilists have largely added to these defects, but these are all factors contributing to the demand for smooth riding streets and pavements, and it is necessary for the railway maintenance officer to meet this demand cheerfully and earnestly if he would give satisfaction.

We who are charged with the responsibility of maintaining the property and who know so well the necessity of well drained, carefully lined and surfaced track, and the need of keeping each structure in a safe and proper operating condition, frequently overlook the value of the little points of contact that we have with the public, and the advantage to be gained by a little extra attention to appearances and the things that please those of our neighbors with whom we rub elbows. Relatively a very large proportion of the public now uses the automobile, and, therefore, the highway crossing is a very important factor of contact, and the automobilist comes from that strata of society which largely moulds public opinion.

On the North Shore Line highway crossings are an important item of maintenance and the management recognized that if we were to give good service and build up good will this item could not be neglected. We have an average of three crossings to the mile and with the ordinary plank or macadam crossing, with its occasional curled up end, protruding spikes, or bumpy contour, there were presented more frequent sources of

*Abstracted from a paper presented before the Maintenance of Way Club of Chicago on January 23.

annoyance (in spite of the best of maintenance) than we could afford. Accordingly we went to work to devise a better crossing.

Develop Unit Plank Crossing

Our first attempt was at building up unit plank crossings. These were made of 4-in. treated timber, framed in the yard in 12-ft. sections to fit between the rails. These sections were bolted to the flange of an old light rail in such a way that the rail formed a support for the end of the next section. Each section was provided with four rings for handling and they were first installed by the use of the derrick car.

We recognized, of course, that this type of crossing could not be easily removed and so the track structure was put in first class condition at the crossing by the full renewal of ties (using sawed ties if possible) by applying clean ballast and by bringing the track to good line and surface. Rails were so spaced as to eliminate joints in the crossing even to the extent of substituting double length rail in the case of very wide crossings. Drainage conditions were given particular attention and artificial outlets provided where necessary. Recognizing that planks wear rapidly, we attempted to prolong the life of the plank against abrasion by a coating of Tarvia and sand.

We found that this type of crossing eliminated the high and loose plank, that there was less breakage due to heavy trucks, better riding qualities for the automobilist, less damage to plank in track repairs, and less wear from abrasion; but it was difficult to remove them for track repairs even to the extent that we found it advisable to adze adjacent ties rather than shim through the crossing when necessary to remedy surface unevenness due to heaving. The element of safety in removing these crossings for repairs also gave us some concern as we found them rather slow in removal and it was necessary for the section foreman to protect traffic with a flagman—a thing he was not accustomed to do in the ordinary crossing repairs.

These unit type of crossings, however, taught us many things, the most important of which was the value of good workmanship. Our present standard practice in regard to plank crossings has been largely influenced by our experience with these unit crossings. We have standardized on the routine of track maintenance outlined, also on the use of treated timber and the blanket-coat of asphalt and sand. We have learned the value of proper framing and our crossings are now put down to stay by bridgemen. The flangeway, a source of frequent claims, is now formed by grooving the plank next to the rail and we are using only 4-in. by 6-in. plank.

However, plank crossings built with this care are not entirely satisfactory. There is a good deal of difficulty in removing them to make track repairs and when a plank is removed it is usually an immediate subject for renewal. They do rot and they do break up under the heavy truck traffic and they cost a snug sum when so carefully built.

Adopt Bitumen-Macadam Type

On account of the ease of repair, their less first cost, and the ability to use common labor in their construction and maintenance, we have largely adopted an asphalt-macadam crossing.

We are using somewhat more binder than advocated by the manufacturer, also some sand with the binder. We think it makes a denser mixture and also prevents "bleeding" in very hot weather. We also find it important to build the crossings high so that when rolled down and ironed out by the street traffic the top will be level with the top of the rail. We provide no flangeway but prefer to let the rail traffic make its own flangeway. It is also important to have the rail well painted with asphalt and the mixture thoroughly rammed around and under the rail.

Example of a Bitumen-Macadam Crossing at Lake Bluff, Ill.

When well built this crossing wears well, needs comparatively little maintenance and while perhaps it does not look quite as well as some other crossings it rides well and pleases the automobile driver.

As a final word, let me emphasize by repetition, that rail joints need frequent maintenance and that therefor they have no place in a highway crossing. Keep them out in the open where you can give them the attention they require and both they and the crossing will fare better.

Metropolitan Club Committee Reports on Bitumen Crossings*

While there are many methods of securing the necessary smooth surface in road crossings, no small proportion of these methods are practically prohibitive because of their high first cost and their subsequent high maintenance charges. This condition has led to the development of a type of crossing, in which bitumen or similar type of compound is utilized. This general type of crossing has been found to give excellent results, being comparatively low in first cost, easy of application even

*An abstract of the report on good road crossings presented before the Metropolitan Track Supervisors' Club at New York, on January 12.

under traffic, readily repaired, low in maintenance costs and smooth in surface. The committee, therefore, confined itself largely to a review of a number of installations of this general character, although considerable attention was given to other forms, such as concrete, plank, brick, etc.

The expense resulting from the high maintenance costs of crossings utilizing oak planks, brick, etc., has brought into the market a number of substitutes, the more common of which are:

1. Tarvia K. P. (A coal gas tar.)
2. Barber Cold Repair Cement. (An oil residue.)
3. Headley No. 1 and No. 6. (An oil residue.)
4. Kentucky Rock Asphalt. (A mineral rock containing asphalt.)

All of the above compounds are applied cold, a feature that is particularly desirable in the maintenance of way department. The methods used in applying Nos. 1, 2 and 3 are similar and the cost for labor and material is about the same for any one of the three. Under general conditions the average costs per square yard are about as follows, all material for the stone foundations in cribs and up to about 3 in. below the top of the rail being excluded:

Binder Course	3 gal. oil.	
	2 cu. ft. standard ballast	
	2 cu. ft. ¾-in. stone.	
Top Seal Course	1/3 gal. oil.	
	1/6 cu. ft. sand or grit.	
Cost of Above	Material	$1.20
	Labor	.30
Total		$1.50 per sq. yd.

Kentucky Rock Asphalt, No. 4, is a natural rock which is pulverized by machinery and which contains enough asphalt in it to solidify when tamped in place. In using this material, ¾-in. stone is placed to a height of about one inch below the top of rail, after which the Kentucky Rock Asphalt is spread to slightly above the top of rail and tamped or rolled to a firm surface.

Any estimate of costs for asphalt should include the cost for a 2-in. layer of stone, since when it is used the ¾-in. stone is brought up to a heighth about 2 in. greater than with the other types of bitumen crossings. The cost for Kentucky Rock Asphalt is $12 per ton, f. o. b., Kentucky. Freight charges amount to about $1.75 per ton. One ton covers 11 sq. yd. and the cost per sq. yd. is as follows:

2 cu. ft. stone	$ .12
K. R. Asphalt	1.25
Labor	.25
Total	$1.62

The work of preparing the crossings for any of the materials is practically the same. This consists of digging out the old ballast to a depth of at least one inch below the bottom of the ties. In multiple tracks, the center of the inter-track space is generally hog-troughed about one foot lower with a French drain or tile in the bottom.

The material should be unloaded as near as possible to the location of the work. The rail should be relaid without joints in the crossing, necessary tie renewals should be made with tie plates and full spiking and the track brought to good surface and line. Flangeway guards are recommended. The material should be used generously for many poor installations have been made by trying to save on the materials.

The upkeep is simple, requiring only the keeping of a few yards of ¾-in. stone and a barrel of oil at some convenient though inconspicuous point so that a track walker can readily and easily make repairs.

The cost per square yard of these types of crossings varies according to the number of train movements, the weight and number of the vehicular and pedestrian traffic over them, and the cost of materials and labor in various localities. Several roads have utilized these bitumen compounds in repairing and rebuilding existing crossings of the Belgian block and other types with a resulting saving in costs, both for installation and maintenance.

One of the large eastern systems constructed a crossing to take care of a very heavy traffic, amounting to 16,000 vehicles between 7 a. m. and 7 p. m., by utilizing Belgian blocks and Headley oil. The blocks were set about 3 in. below the top of rail and the remainder built up in the usual manner for this class of oil. The crossing has given good service and shown considerable flexibility in the matter of repairs. The traffic at this point is greatly unbalanced, the east side of the street having about three times the travel of the west side. This is reflected in the maintenance in a way which also illustrates the ease of repairs, the east side having been repaired three times since the installation and the west side once.

Another large system reconstructed a Belgian block, girder rail crossing which had become exceedingly rough, by an application of oil and stone. The surface of the street was first swept clean, after which it was flushed with straight Headley compound. It was then covered with a mixture of 1½ gal. of oil to 1.0 cu. ft. of ½-in. stone. The area covered was 22 ft. by 24 ft. and the depth of the application was between one and two inches. This work was done in July, 1922, and to date very little of the material has worn off.

One very large crossing in the east, covering 1,220 sq. yd. and including 2 main and 12 side tracks, was rebuilt in an interesting manner. Seven tracks and inter-track spaces were built of sawed bridge ties set on end on a 1-in. sand cushion over 12 in. of ballast. These blocks were then dressed and cemented together by an application of Tarvia K. P. The other seven tracks and inter-track spaces were filled in with one inch stone to within two inches of the top of rail and the ballast well compacted by hand and by roller. A mixture of stone and Tarvia properly cured was placed on this to a depth of three inches or one inch above the rail, after which it was well rolled with a 10-ton roller. In about five months after a few scattered depressions had developed, a coating of Kentucky Rock Asphalt was spread over the entire crossing, bringing it to a smooth, even surface. Flangeways were provided by the use of "Baltimore" rails. This road has also used paving bricks carefully laid on a ½-in. sand cushion on well tamped ballast which had previously been given a dressing of asphalt in the ratio of about 1½ gal. per sq. yd. All joints were sealed with a coating of Tarvia K. P. These brick crossings cost about $5 per sq. yd. exclusive of the ballast.

Although most of the roads follow the same general practice in constructing bitumen crossings, one road varies this by carrying the mixture to a greater depth. This road cleans out the old ballast to below the tie and puts in and thoroughly tamps clean No. 4 stone ballast to within two inches of the top of the tie. The remaining height up to two inches below to one inch above the top of the rail is then filled in with a mixture of ¾-in. stone and Tarvia or Barber cement in the proporton of 10 pails of stone to one of oil. This is well rammed as it is built up and given a final surface dressing of sand or stone screenings as a binder. A number of heavy track crossings have been built up this way and the subsequent repairs have been quite small. Hardwood creosoted ties, fully tie plated and double spiked are installed at the rate of 20 to a 33-ft. panel. It was the experience of this

road that a top surface of three inch depth did not hold up well, often developing cracks after a few weeks service, through which the dry stones worked up.

A variation in the usual type of plank crossing is illustrated in the practice on one road which utilizes short lengths of plank laid diagonally on furring strips. Baltimore rails are used for flangeways, the furring strips being spiked to the ties about two inches from the Baltimore rail and down the center line. A further improvement in this type of crossing has been secured by coating it with Kentucky Rock Asphalt, using an asphalt paint applied to the plank as a binder. This has resulted in a smoother crossing and a surface which can be easily maintained or repaired.

Another variation in the usual plank crossing is illustrated in an experimental installation recently made by one large road. This is a double track crossing where the vehicular traffic is unusually heavy to and from a freight yard. It is built up of second-hand oak, 7-in. by 9-in. switch ties. These ties are installed in conjunction with rails for flangeways and so placed that they break joints. They are spiked to the track ties with wire spikes The committee, in conclusion, recommended the increased use of bitumen crossings to replace existing crossings of plank, concrete, skeleton crossings, brick, Belgian block, etc., believing that the use of bitumens will overcome many of the defects and drawbacks of the types mentioned. These may be stated briefly as follows:

Plank: High maintenance charges, danger to equipment, etc.

Concrete: High first cost, tends to crack and disintegrate, difficult to repair.

Skeleton: Unsuitable for heavy traffic.

Brick: High first cost.

Belgian block: High first cost, poor surface.

The committee also recommended that exceeding care be taken in the installation of oil or asphalt crossings along the following lines:

Good line and surface.

Large treated hardwood ties, fully tie plated and double spiked to prevent looseness and vibration.

Elimination of all joints in the crossing.

Utilization of metal flangeways on any but the lightest traffic crossings.

The generous use of the oil or bitumen in order to secure good binding and an impervious crossing.

The provision of good drainage.

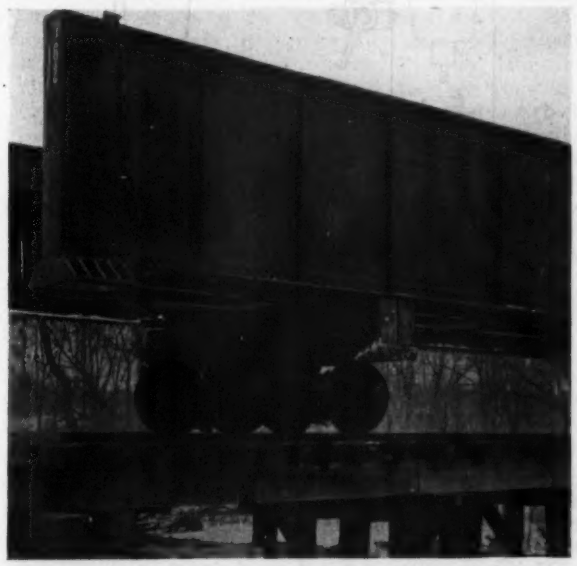
A. E. Preble, Chairman, Supervisor, Pennsylvania System, Paoli, Pa.

Moving a Bridge Span on Car Trucks

By F. H. Cramer

Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

THE transfer of a 60-ft. through girder span weighing 43 tons from one site to another over 6½ miles of track on trucks is a feat carried out on the Burlington to meet the changing requirements of waterway openings as a consequence of a farm land drainage project along one of its lines in Missouri. This drainage operation increased the waterway requirements at one bridge and decreased them at another so that the girder span in service at one opening was no longer required there but would serve very well at the other. After some study of the problem it was concluded that the cheapest and quickest way of making the transfer would be on car trucks. To release the girder span it was necessary to install a pile trestle bridge of five openings. The piles for this trestle were driven through the bridge floor and capped so as to just clear the bottom flanges. Two bolsters were prepared for supporting the girder span on the trucks, these bolsters each consisting of two 9-in. by 24-in. wooden stringers bolted together side by side and braced with steel rods for cantilever loading.



How the Girders Were Mounted on the Truck

At the new site of the girder span preparations were made for providing temporary pile piers to receive the ends of the girders while the pile bents of the existing trestle, which would not clear the new steel, were cut down and recapped and the difference in elevation made up with blocking.

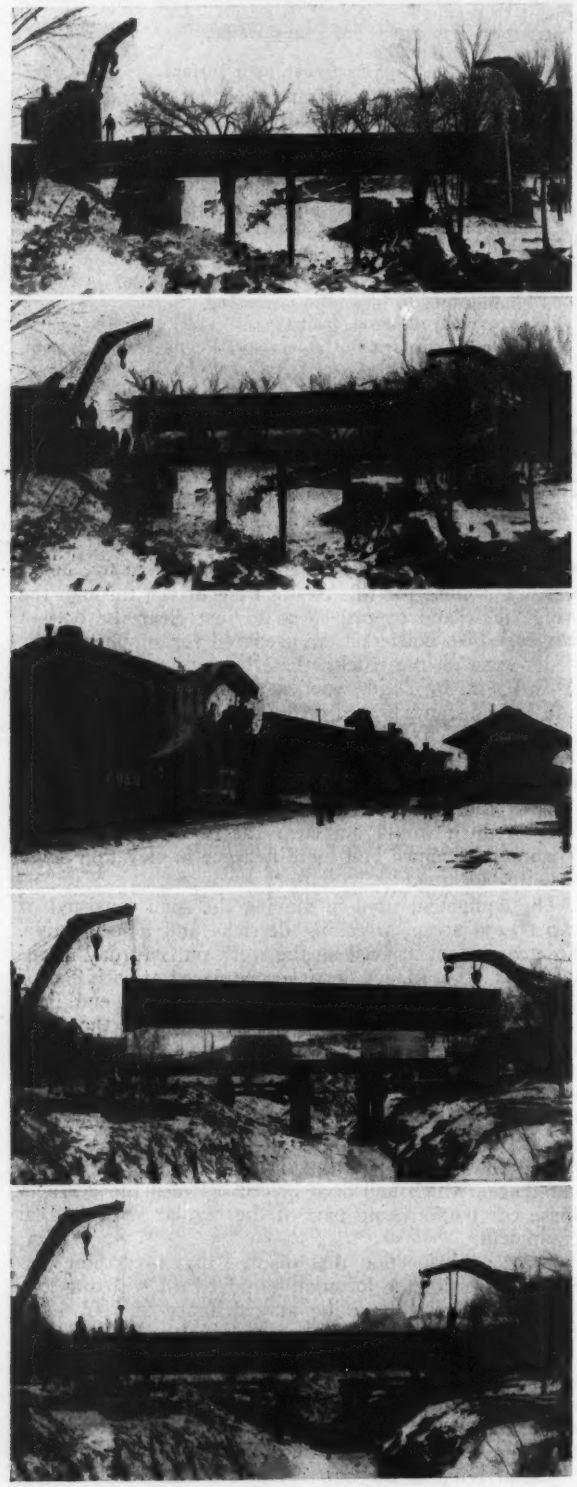
The equipment used in moving the span consisted of two 60-ton steam wrecking derricks and a locomotive. This equipment arrived on the work on Saturday morning at 11:00 a. m. A derrick was placed at each end of the span, chains were fastened around the end floor beams as close to the girders as possible, and the spans were then picked up and set to one side on falsework. A bridge gang immediately set to work installing the stringers, ties and rails, completing the trestle ready for the passage of trains in three hours. On the following day both derrick cars arrived at the bridge at 7:15 a. m., picked the span up off the falsework and set it on the car trucks which had been placed between the derricks, these car trucks being part of the regular wrecking car equipment.

After an inspection that insured that everything was in proper order the locomotive moved off with the load and proceeded to a siding at a distance of 5.42 miles, without mishap. Here it was necessary to stop to meet a passenger train at 11:10 a. m. Following the departure of this train the girder span was moved onto its new site, although in order to pass the siding it was necessary to take down the switch stands and to remove the wing fences at the cattle guards.

On arriving at the new bridge site the derricks were set in position to raise the girder, with sufficient space

to clear the trucks when moved back from underneath the span. The derricks then held the span suspended while the trucks were rolled out of the way and the bridge force dismantled the old wooden deck and the blocking on top of the bents so that the span could be set down on the temporary abutements. The span was set on the piers at 12:45 p. m. and was ready for traffic at a speed of 25 miles per hour at 1:40 p. m.

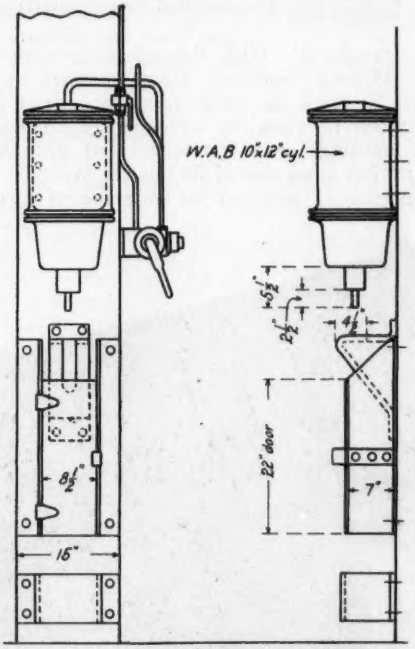
The total distance that the span was moved was 6.32 miles. This method of moving was possible because the only obstructions which would not clear the girder span, namely, the switch stands and cattle guard wing fences, could be moved readily. The method would not be applicable in the face of fixed obstruction. The chief economy of this method lay in the fact that it saved the expense of dismantling the girden span and reassembling the various parts at the new site.



Five Stages in the Transfer of the Span

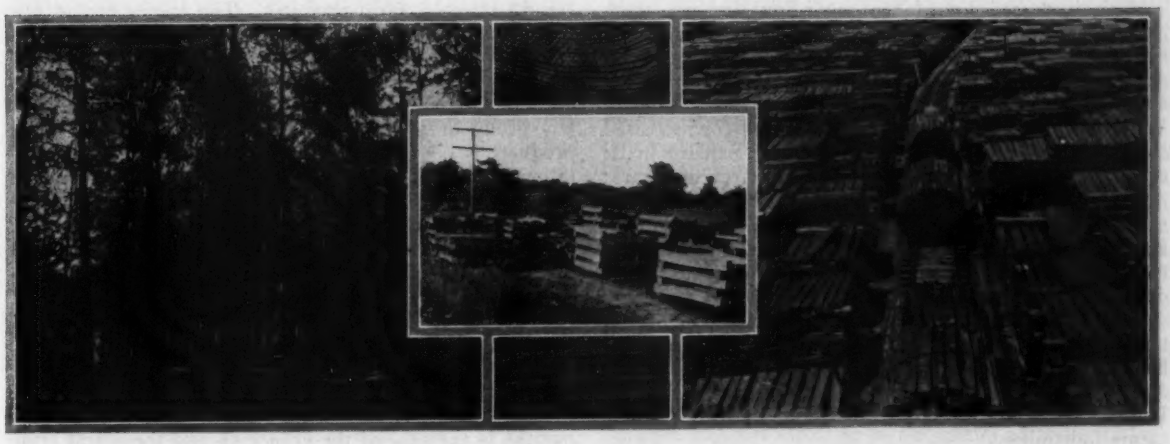
A Cheaper Way to Extract Handles from Old Tools

AN INTERESTING device which has expedited the removal of handles out of tools has been built at the Chicago, Rock Island & Pacific shops at Silvis, Ill., in connection with the scrapping or repairing of mauls, clay picks, sledges, tamping bars and similar tools. These handles are removed by a mechanical punch consisting of a 10-in. locomotive tender air brake cylinder bolted to one of the posts supporting the first floor of the storeroom. The cylinder is inverted so that the piston travel is downward, and a punch is welded on the end of the piston for punching the handles out of all of the old tools. Below the cylinder, at a suitable distance, is fastened a wrought iron yoke or jaw into which the tools are placed, the removal of a handle thus being accomplished simply by placing the tool on the jaw with the handle downward and letting the air into the cylinder.



Details of the Track Maul Handle Punch

The device was installed at slight expense and has proved decidedly economical. Prior to its installation it was the practice to remove the handles by means of a hand punch and sledge, requiring two men, while the work is now performed much more quickly by one man. The handles removed are inspected and if in satisfactory condition are re-issued for further use, in the original form or in shorter lengths for tools where a shorter handle is satisfactory.



The Tie Industry Through the Eye of the Camera

Tie Producers Anticipate Heavy Demand and Steady Prices

Reports Presented at Kansas City Convention Indicate That Adverse Weather Conditions Have Handicapped Production

TIE PRODUCTION is proceeding on a liberal scale, but the adverse weather in recent weeks has interfered so seriously with the making of ties that the number available will not exceed and in some places may be considerably less than during 1923. This was the gist of reports presented by representatives from the more important tie-producing areas at the sixth annual convention of the National Association of Railroad Tie Producers at Kansas City, Mo., on January 17-18. The sessions were presided over by Timmons Harmount of the Harmount Tie & Lumber Company, Chillicothe, Ohio, president of the organization, which includes in its membership 51 companies engaged in the production of cross ties for railway use. In addition to the reports of conditions in the tie producing areas, several papers were presented on problems affecting the production of ties, some of which are abstracted below. An outstanding feature of the program was an address made by L. W. Baldwin, president of the Missouri Pacific, on The Railroad Problem and the Tie Producing Industry.

After calling the convention to order, Timmons Harmount, president of the association, referred to the campaign which the association has launched to promote uniform buying of ties by the railroads. There is no question, he said, but that uniform buying will tend largely to stabilize the tie-producing industry both as to volume of production and prices which stabilization will be of equal or even greater benefit to the railways than to the tie producers. He also referred to the wide fluctuations in the prices of ties in some sections of the country during 1923, and expressed the hope that prices will be more uniform during this year. As a means of promoting stabilization he suggested that the association consider the advisability of establishing a bureau to compile statistics of production and stocks of ties. He deprecated the attacks which are being made on the railways, and in response to his suggestion, the association adopted resolutions advocating more favorable treatment of the railways and requesting each member to use his personal influence to bring about a more favorable attitude towards the roads.

Developments in the Tie Industry

Dr. Herman von Schrenk, consulting timber engineer, St. Louis, Mo., described the developments which have taken place in the tie industry during the last 20 years. Most important among these developments, he said, is the change in specifications. Twenty years ago few dimensions other than length were specified. The American Railway Engineering Association issued its first table of tie sizes in 1905. Prior to federal control the roads commonly specified only two grades, the No. 1 or better grade being encouraged and the No. 2 discouraged by depressing prices. The preparation of the United States Railroad Administration specifications opened a new era. The standardization of ties according to their sizes and groups was an important development which has come to stay. While some roads have not adopted these grades in their entirety, Dr. von Schrenk expressed the opinion that in general they are recognized as satisfactory.

Marked changes have also occurred in the manufacture of ties. Not many years ago practically all of the ties produced were hewn, largely at odd times. The first sawed ties appeared about 1900, since which time the proportion has increased steadily. The points of production have also changed. Right-of-way production formerly prevailed, whereas the length of haul from point of cutting to point of use now averages approximately 700 miles and the transportation cost frequently equals that of production. With the depletion of the best supplies of timber, many kinds of trees are now being cut into ties which were formerly not used. White oak, which was once used almost universally, has been supplanted by variety of timbers, particularly since the development of the science of timber treatment.

With increased knowledge regarding timbers, there has developed a great change in the methods of handling ties. The oaks which were formerly used in large quantities did not suffer greatly from careless handling and such damage as occurred was not readily evident. With the use of other woods, the necessity for increased attention has become more pronounced. Sap rot in its early stages was not recognized until recent years; neither was the necessity of seasoning ties under proper conditions realized until lately. Dr. von Schrenk emphasized the necessity for the movement of the ties to concentration yards with the minimum delay to avoid deterioration.

In conclusion, Dr. von Schrenk emphasized the importance of reforestation. He referred to the failure which has characterized the attempts to import ties from South America and other foreign countries and stated that the United States must prepare to supply its own requirements indefinitely.

Conditions in the Field

A feature of the programs of this association is the presentation of reports of conditions prevailing in the principal tie-producing areas. In brief, the reports this year were to the effect that conditions are now favorable for a large production in the Rocky Mountain district in spite of the fact that heavy rains have interrupted seriously with the "driving" of ties on the streams. In the Minnesota-Wisconsin territory a large number of ties were produced in the fall, but difficulty is now being encountered, particularly by the smaller producers, in getting these ties out of the woods. The indications are that the production this year in this territory will be approximately equal to that of 1923. In the Missouri-Arkansas-Texas territory the demand fell off sharply in August but picked up later in the fall and remained good until recently. As a result the production during the last half of 1923 was far below normal, and stocks have, in general, been shipped out. Experienced labor is now plentiful and it is anticipated that the quality of the ties produced will be better than last year. In the southern territory east of the Mississippi river the production declined late in 1923, but has increased recently and many ties are now in the woods awaiting the improvement of road conditions to bring them out.

The Railroad Problem

An important feature of the convention was a luncheon meeting at which L. W. Baldwin, president of the Missouri Pacific, spoke on the Railroad Problem and the Tie Industry, in part as follows:

I feel that we can face the future with confidence and a degree of optimism justified by conditions generally throughout the country. As far as the railroads are concerned, there is no question but that they are functioning better than they were a year ago. We have recently enjoyed a splendid increase in the volume of business and we have been able also to accept more business than was offered and to handle it with satisfaction to shippers. You know of the increased expenditures for equipment, supplies and facilities. And you know, of course, how those increased expenditures have resulted in a wave of prosperity that touched almost every industry in America.

The most menacing cloud on the horizon is the threat of certain self-appointed champions of the farmers' cause to penalize the railroads for the fancied ills of agriculture. There has been continued agitation for lower freight rates on farm products. The theory of the agitators is that lower rates will help to restore the purchasing power of the farmer. If that were true, something ought to be done about it. But it is not true. I question if lower freight rates would help any farmer or any group or any section. The market price of farm products is not dependent to any extent upon transportation costs. The market values are determined by the law of supply and demand, and the demand is dependent upon the purchasing power of the consuming public.

Agricultural products are necessities. People must have food and clothing. But the quantity and the quality purchased by the ultimate consumer will be in direct ratio to the condition of the consumer's pocketbook. If the country is prosperous there will be a market for the raw materials produced on the farms. However, the market never will absorb a great surplus of any particular crop. Witness what happened in the last six months in the case of the corn crop and the wheat crop. During that period the aggregate value of the corn crop increased approximately $300,000,000. During the same period, the total value of the wheat crop decreased about $147,000,000. And there was no change whatever in the freight rates on either commodity during that period.

You hear a lot about the valuation of the railroads and the effect that valuation will have on freight rates. You hear antagonists of the railroads charging that rates are kept at a high level because of the necessity for earning returns on those valuations. I want you to know that such charges are made without any foundation in fact.

For rate-making purposes, the Interstate Commerce Commission accepted a tentative valuation of $18,900,000,000 as of December 31, 1919. This figure is based on the value of railroad properties used in the production of transportation service, and it is based on costs and prices up to and prior to 1914. There is no wartime inflation in this figure, which is largely arrived at as a result of ten years of investigation by government experts and the railroads.

Consider the Various Items

One way to arrive at an understanding of the vast amount of capital tied up in the railway plant is to consider the various items separately. There are approximately 400,000 miles of railroad track in the United States. This includes, of course, main running tracks, second tracks, side tracks, yard tracks, passing tracks, etc. At only $25,000 a mile, the value of this track would be $10,000,000,000. It goes without saying that this track could not be replaced at that price. The U. S. Department of Agriculture estimates that the average cost of a mile of improved highway today is $36,000 and such highway does not have any rails, ties, tunnels, trestles and comparatively few bridges. There are on our railroads today 69,000 locomotives. If we accept an average value of only $20,000 each for these, their value would be $1,380,000,000. Our 2,400,000 freight cars at only $1,000 each would be worth $2,400,000,000. Passenger train cars number a few more than 57,000. At only $10,000 each they would be worth $570,000,000. It is conceded without argument that materials and supplies that must be carried in stock by the railroads are worth conservatively about $500,000,000, and the amount of working capital necessarily required is an equal amount, or another billion dollars for these two items.

There are approximately 50,000 stations and terminals in America, and the value of these, together with yards, signals, roundhouses, shops, machinery, water supply plants, power plants, elevators, docks, coal pits and other

items, easily total more than $7,000,000,000. There are more than 1,000 cities and towns in America with railroad terminal plants that cost more than a million dollars each. This alone would account for another billion. The shops and shop facilities, employing more than 400,000 men, constitute an enormous industry in themselves. It is extremely doubtful if these terminals, shops and other facilities could be duplicated today for ten billion dollars, but they are conservatively figured at only seven billion, as I said. All these items which I have mentioned total more than $22,000,000,000.

The total par value of all outstanding railroad securities is less than this figure, and the market value of these securities is only about half of that amount. It stands to reason then that any plan for arbitrarily declaring the fair valuation of the railways less than their actual worth is nothing more or less than confiscation.

There was a general 10 per cent reduction in freight rates in 1922, effective July 1 of that year. It is estimated by the Interstate Commerce Commission that this reduction lessened the revenues of the railroads about $500,000,000 during 1923. The principal result has been that many railroads, while transporting the largest volume of business in history, have failed to earn any profits. A further reduction, at this time, whether based on a downward revision of railway valuation or on any other pretext, would without doubt work unwarranted hardship on most railroads.

The Effect of a Reduction in Valuation

If that condition arises, the railroads will have only one course open to follow. They will be compelled to retrench in every possible way, and it will then be impossible for them to keep pace with the progress of the country. That retrenchment will have a far-reaching effect in more ways than one. If the revenues of the railroads are further reduced they will necessarily have to curtail their purchases of railway materials, cars and locomotives. Smaller orders will result in many plants in allied industries going on part time or closing down. Men out of work purchase only the barest necessities, and so the markets for manufactured articles would be seriously affected, with the result that more and more men would be faced with the problem of unemployment. Those persons who profess to be trying to help the farmer and the country as a whole are, in fact, playing with dynamite that may wreck our entire economic machine.

I don't believe the great majority of sane, constructive citizens in this country will permit the antagonists of the railroads to do this thing to the country, especially if that majority of our citizenship is thoroughly informed. And that is where you gentlemen can be of material assistance. I hope each of you will resolve to do whatever you can to explain the situation.

As I said, with the exception of this danger, which ought not to exist, the outlook can be called fairly bright. The volume of railway traffic ought to continue at or near the high levels recorded in 1923. The railroads always are a good business barometer. When they are working at capacity, the country is prosperous. And, of course, when business is good, and there is plenty of it, the railroads will continue to buy new equipment, and new tracks, build needed new facilities and in various other ways contribute to the general prosperity.

We expect to be able to continue to provide shippers with an entirely adequate and satisfactory service. And by doing that we feel that we will be contributing our fair share to normal development and progress. With adequate railroad transportation, all business benefits. The local merchant is enabled to do more business with a relatively smaller capital investment. With dependable freight service his turnover can be effected more easily. The same thing applies to the manufacturing industry. Factories can operate with smaller stocks of raw materials. Banks are helped because they are not required to carry long-term paper. With more liquid credits, they in turn can make more capital available for legitimate expansion and development. Farmers will be helped because with an adequate and dependable transportation service they will be enabled to take advantage of favorable markets and realize the utmost for the things they produce.

How to Help the Roads

If men in public life—politicians and others—really want to help the country I would like to suggest to them that they pay more attention to the question of reducing taxation and less attention to the matter of trying to legislate prosperity into the pockets of any particular class or group by taking something away from the railroads.

Ten years ago railroad dividends were about two and a half times as much in the aggregate as railroad taxes. The figures gradually approached each other, dividends dwindling and taxes increasing until in 1922 taxes paid by the railways exceeded the dividends paid by them by 11 per cent.

I am not one of those who believe that all regulation should be removed from the railroads. The railways are essentially public service institutions and as such they are subject to reasonable regulation. But too much regulation defeats the very purpose it is intended to serve. Multiplying regulation and supervision requires additional thousands of government employees, and these must be paid out of public funds. These funds must be collected by the government in the form of taxes, either direct or indirect.

Production of Southern Pine Ties

By C. D. Christian
Standard Tie & Lumber Co., Meridian, Miss.

The term Southern yellow pine includes the several species of pine growing in the southern states from Virginia to Texas, among which are longleaf, loblolly, shortleaf, slash and pond pine. In my section of the South (Mississippi), the shortleafed pines are common and popularly known as rosemary pine, forest pine, oldfield pine, loblolly pine and spruce pine.

All so-called Southern pine is yellow pine. While the several species of pine are easily recognized, they frequently blend so that a tree of one species will sometimes partake of the characteristics of other species. The writer has seen longleaf trees growing near oldfield pine that had some of the common characteristics of oldfield and yet retained the very long needle and large cone. The several shortleaf pines are frequently so intergraded that experts will differ as to the kind of tree a specimen is.

What is true of the blending of the trees while growing is especially true of the timber from the trees, so the Southern Pine Association several years ago undertook to remedy this situation by dividing all Southern pine into two classes: (1) Dense Southern yellow pine and (2) sound Southern yellow pine, these terms being descriptive of quality and not of botanical species. The classification is as follows: "Dense yellow pine shall show on either end an average of at least six annual rings per inch and at least one-third summerwood, or

else the greater number of rings shall show at least one-third summerwood, all as measured over the third, fourth and fifth inch from the pith. Wide ringed material excluded by this rule will be acceptable, provided the amount of summerwood as above measured shall be at least one-half. Sound Southern yellow pine shall include pieces of Southern pine without any ring or sum merwood requirements." For the purpose of determining the density of the wood the point of measurement of the stick of timber is the third, fourth and fifth inch from the pith. It has been demonstrated by experiments that the summerwood is stronger than the springwood. Therefore, in selecting timber for strength, the summerwood content is the practical concern of the buyer and not the species of pine.

Should Dense Pine Be Specified?

It is a question in my mind whether it is better for a road to buy dense pine ties or sound pine ties. I think it is true that in any quantity of Southern pine ties a large percentage will class dense, so that a road buying Southern pine ties, without insisting on density, gets a large percentage of dense ties. The small percentage that will not grade dense could profitably be used in tracks where as much strength is not required. Many of the roads have bought pine ties for a number of years without regard to their density and must have obtained satisfactory results as they continue to buy the same kind of ties.

When the difference in cost of the dense ties is considered and the waste of timber (for their are some ties in almost any stand of timber that will not satisfy the density rule), would it not be more practical to buy sound Southern pine ties? The percentage of ties that must be dense could be specified, as is done in buying No. 2 and better lumber (there usually 65 per cent must be No. 1 common). If this kind of buying was practiced, the ties would be easier to obtain and could be bought much cheaper. The writer has observed that on every yard where dense ties are bought, a substantial number is left from each inspection that do not satisfy the density rule. After the ties are gone through no other road wants to send an inspector to go through them, so they have to be sold as rejects or left to rot. The result is that the producer makes no money on this class of tie unless charging enough to take care of the percentage that he knows will be left.

Assuming that the engineering department has decided that dense pine is to be bought, how shall the proper density be determined? The term "longleaf" is frequently used where only dense is meant. But if longleaf is specified, a producer has to base his quotation on strictly longleaf. It is becoming more and more difficult to get real longleaf sap pine ties. All of the large acreage in longleaf timber is owned by mills, and they would not think of making cross ties from this timber at the prices that are paid for ties. The writer ventures to say that few orders for sap pine ties have been filled entirely from longleaf timber in recent years, and yet the purchasing departments are daily asking quotations on longleaf ties. If dense pine satisfies the same requirements as longleaf, would it not be better to specify dense Southern pine? The methods in practice for determining density are varied. Most roads employ the old United States Railroad Administration requirements for ties from needle leaf trees to the effect that there must be five annual rings to the inch and one-third summerwood or one-half summerwood in fewer rings. One road uses the Southern Pine Association grading and make the third inch from the pith the test. Other prominent roads follow the American Railway Engineering Association specifications to the effect that ties from needle leaved trees shall be of compact wood throughout the top fourth of the tie, where any inch of any radius from the pith shall have not less than one-third summerwood in six or more rings of annual growth, or not less than one-half summerwood in fewer rings.

Where the Wood Is Densest

In Southern pine the annual rings are usually fewer in the heartwood when heartwood is present in the tie. If the tie contains heart the pith of the tie is the center of the heart. The heartwood is of less compact wood than the sap wood. In my section probably 98 per cent of the sap pine ties are rifled ties, with possibly 2 per cent split. Heartwood is present in a large percentage of ties that are hewn from any pine exept oldfield and spruce pine. The rings are fewer and further apart in the heart and are closer together as the outside of the tree is approached. In hewing or sawing the ties the closest rings are necessarily destroyed in slabs or juggles. Consider a log with a heart center four inches in diameter. In this heart center the annual rings are not close together. If we make a 7-in. by 9-in. tie from the cut we get enough rings to average five to the inch, where if we make a 6-in. by 8-in. tie from the same stick we hew off the closest rings and make a tie that will not satisfy the present density rule. Here is an example of one tie passing and the other being rejected, although made from the same cut. If we extend the same line of inquiry further we find that, as we go up the tree, the rings get closer together and the heart gets smaller, so frequently a 7-in. by 9-in. tie made from the butt cut under the rule will be rejected and a grade 2 tie will be accepted from the same tree.

In order to remedy this condition, I make the following suggestions:

(1) Whenever possible make no density specification.

(2) If dense ties are required, specify dense and not longleaf.

Discussion

John Foley, forester, Pennsylvania System, called attention to the fact that the American Railway Engineering Association's specifications for standard cross ties made no distinction between the several species of southern yellow pines. Adherence to that standard would relieve any railroad from making itself ridiculous by insisting on longleaf pine, which is rarely obtained exclusively, since the standard specifications provide that all ties are to be of compact wood unless coarse wood is specially ordered.

Mr. Foley also pointed out that the relative quantities of compact and coarse ties delivered depended on the locality of production, the quality of the site and the density of the stand. Where longleaf pine predominated, compact wood would be expected. Where the soil is poor, slow growth will provide compact wood in pines other than longleaf. So will dense stands of trees growing close together, while longleaf pines growing far apart will yield ties of coarse wood. Therefore it does not follow that if the vicinity in which Mr. Christian operates provides a large proportion of compact ties, equal quantities are to be had from other localities.

As a matter of fact, the reverse is the case elsewhere, and the railroads dependent on the territories in which southern pines grow rapidly wisely refrain from distinguishing between compact and coarse wood. They are almost exclusively lines which find 6-in. by 8-in. ties satisfactory for their main tracks, and it would not pay them to sort out the comparatively few ties of compact

pine they obtain for use in places of especially heavy traffic. They have hardwood ties already separated available for such use.

While it is doubtless the case that the railroads ordering ties of compact pine only have side tracks in which coarse wood can be used, they are generally lines which import their ties from a considerable distance and cannot afford to pay freight on low-grade material. They obtain chestnut and other ties locally along their lines for such purposes as ties of coarse pine could serve, and they will not waste the money involved in sorting compact from coarse wood. That separating can be done most economically where the ties are manufactured, and if the railroads now confining their consumption of Southern pine ties to compact wood are to be converted to the use of some coarse wood, the appeal should be made through separate carloads of coarse ties, which can be distributed where desired and through a lower price for such poorer ties.

The manufacturer of a log who whittles it down from a compact 7-in. by 9-in. tie to a coarse 6-in. by 8-in. has no right to hold railroads responsible for this lowering in the value of his product. If he uses a sawmill in his operations he turns out lumber from the outer portion of the log which produces the boards freest from defects and, therefore, of the highest grades and value. One of the reasons for the prejudice against sawed ties is based on the practice of making them from the poorest part of the log and from the poorest logs.

The upper portion of a tie subject to the abrasion of rail wear is where compact wood is needed, and a tie which lacks this section of resistive fibers is not as useful a tie as one which has a top quarter of standard rings and strength.

Cross Tie Production on the Pacific Coast

By Mason E. Kline
Sales Engineer, Charles R. McCormick & Co., San Francisco, Cal.

Less than one-third of the original stand of virgin timber of the United States remains and over one-half of this is in West Coast forests. More than 60 per cent of the total remaining forest resources of this country are concentrated in Montana, Idaho, Washington, Nevada, Arizona, New Mexico, California and Oregon. After makig a liberal allowance for increase over the present annual cut of the Pacific coast, there is still sufficient timber to last approximately 50 years, and with an intelligent system of reforestation, such as is now being developed, it is possible that the supply will last much longer.

As wood preservation and protection from mechanical wear are perfected, tie producers will depend more and more on the so-called softwoods. It may be well, therefore, to note that the entire softwood stand of the nation is 1,755,218,000,000 ft. b.m., of which 1,364,172,000,000 ft. b.m., or approximately 78 per cent, is located in the West, while the remaining 391,046,000,000 ft. b.m. is in the southern and eastern states, giving the West 3½ times as much softwood as the entire South and East. While southern pine will remain an important factor for years, its consumption will be largely as a specialty wood, which will make the price prohibitive for ties. Consequently, each ensuing year will place a greater demand upon the West.

Unfortunately, the figures which would show the ties produced on the coast are very meager because the majority of ties are sawn and these figures have been included with those for lumber. However, the following are authentic as far as they go.

Douglas Fir Now Widely Used

Prior to the war the eastern seaboard had not used any Douglas fir ties, while today the annual purchases by eastern railroads aggregate approximately 1,000,000 ties. The western roads tapping this territory are also buying approximately 8,500,000 Douglas fir ties annually. The figures available from the Forest Service show a total production of 6,777,000 Douglas fir ties in 1909, while 1920 shows over 11,200,000. Accurate export figures are likewise missing, but estimates of the best informed exporters place the 1920 exports at 100,000,000 feet of ties.

The annual production of redwood ties is approximately 2,400,000 pieces. This production has remained practically constant during the last five or six years.

Cedar tie production has fallen to around 75,000 pieces and does not constitute a firm schedule, but rather the cleaning up when this species occurs in the course of other production.

Redwood ties are sold largely on specifications based on the American Railway Engineering Association standard, with no reference to density due to the nature of this wood. The majority of the ties for domestic consumption are split, bringing about $28 per thousand board feet at mill points. Heretofore, only sawn ties have been purchased for the export trade. These bring a higher price, the prevailing figure now being around $32 per thousand board feet at the mill.

Greater Use of A. R. E. A. Specifications

Though the quantity offered is relatively small, hewn cedar ties for domestic use are bringing approximately $27 per thousand board feet, f.o.b. loading points, while those sawn for export average some $10 per thousand higher.

Perhaps fir more than any other species has been subjected to a greater variation in specifications, with corresponding fluctuations in price. The earlier specifications permitted the cutting of ties from second-growth timber. These ties sold for around $14 or $15 per thousand, gradually advancing, however, until today such roads as accept ties of this grade place their orders at between $19 and $21. When the war came the United States Railroad Administration specifications, demanding better timber and likewise somewhat higher prices. There is a noticeable trend towards the general adoption as standard of the American Railway Engineering Association specifications.

Some roads considered their requirements called for a tie superior to those produced under the United States Railroad Administration specifications and accordingly drew up specifications which more nearly fitted their needs, embodying therein the density rule. Undoubtedly this had the desired effect of producing ties of unexcelled quality. However, those logs formerly cut into ties were no longer suitable and it became necessary to cut into these ties timber heretofore sold as lumber at higher prices. Obviously, ties of this grade were sold upon a lumber rather than a tie basis, and as such were subject to the usual fluctuations of lumber prices. At present these prices are ranging between $25 and $30 per thousand at mill points.

Because of the long haul and high freight rates, west coast ties were at a very decided disadvantage and suffered a long uphill fight. With the opening of the Panama Canal in 1914, and the establishment of a rate of

approximately $10 per thousand feet, these ties entered the eastern markets on a strong competitive basis. Water rates rose to a peak of $22 in 1920, from which point they have gradually receded until the present level is $12 to New York.

Other Features of the Program

In a round-table discussion of the extent to which the tie producers can separate ties in the field, A. R. Fatham, secretary, Western Tie & Timber Company, St. Louis, Mo., described the current practice of separating ties as received in the local tie yard between white oak, red oak and softwoods, between 6-in. by 8-in. and 7-in. by 9-in. and between 8-ft. and 8-ft. 6-in. lengths. He stated that as far as possible it is the practice of his company, when shipping by water, to make solid rafts of red oak and of white oak ties of the same sizes, and that where this separation is not possible in the formation of the rafts, the ties are separated when banking them. E. E. Boehne, manager sales department, International Creosoting & Construction Company, Galveston, Tex., described the practices of his company in separating each group of each length and of each grade by itself in a central storage yard, with each grade and size stacked by itself so that shipments can be made in full cars of a kind.

The following officers were elected for the ensuing year: President, Walter Poleman, president, Western Tie & Timber Company, St. Louis, Mo.; first vice-president, R. E. McKee, assistant manager tie and timber sales, Long Bell Company, Kansas City, Mo.; second vice-president, M. H. Schussler, Coolidge & Schussler, Minneapolis, Minn.; secretary, J. S. Penney, T. J. Moss Tie Company, St. Louis, Mo. (re-elected); treasurer, B. J. Finch, Finch Brothers, Duluth, Minn. (re-elected). Chicago was selected as the location for the next convention.

Driving Piles Under Water by Means of Submersible Steam Hammers

DRIVING PILES under 20 to 30 ft. of water by means of submersible steam hammers is being done on the Central Railroad of New Jersey with excellent results, in connection with the construction of its new bridge across Newark Bay. Piling from 30 to 45 ft. in length is being driven in a hard bottom

How the Two Knives Attached to the Leads Hold the Piles in Line

at the rate of 60 piles per machine per eight-hour day. Accurate driving has been secured with a resulting small waste of piling by the utilization of telescopic leads and an enclosed steam hammer working under air pressure.

The new bridge of the Central of New Jersey across Newark Bay will be a four-track structure supported upon 72 double pier units and will have a clearance above mean high water of about 35 to 40 ft. These pier units consist of two concrete piers, each measuring approximately 22 ft. by 44 ft. and 22 ft. by 48 ft. at the base. They are supported upon 305 piles driven to within about two to three feet of the bottom of the bay and spaced 2 ft. 6 in. apart. Timber caissons with concrete bottoms are used in the construction of these pier units.

The bay along the line of the structure had previously been dredged to a net depth of 22 ft. below mean low water, which resulted in a maximum depth on most of the work of about 26 ft. 6 in. at high tides. The extreme depth which will be encountered on this phase of the work will probably be about 35 ft. The bottom of the bay is a compact clay, sand and gravel formation and is regarded as hard to drive in. The piles are almost uniformly 14 in. in diameter at the butts and measure from 30 ft. to 45 ft. in length. There is a tide of about

The Hammer Partly Submerged and Ready to Start Driving. The Sliding Leads with the Pile Between Them Are Resting on the Bottom

five feet in the bay, so that at low water the pile tops are about 20 to 21 ft. below the surface of the water.

Two pile drivers are being used on this work, each with the same equipment. The main pile driver leads

are 85 ft. long and support a sliding, or telescopic, form of leads 70 ft. long. The hammers are of the heavy duty, double-acting, all-enclosed type, equipped with long leads for live and exhaust steam and compressed air. Each hammer has a net weight of about 13,000 lb., the weight of the ram being 3,625 lb. The output is 22,000 ft. lb. of energy per blow and requires a 60 hp. boiler. In actual operation, the pile is set in under the driving bottom of the hammer in the sliding leads, where it is lined up and held in position by two knives which are explained in more detail later. The sliding leads are then lowered to the bottom of the bay, after which the hammer is started and continues to drive until the piles

The Hammer Working Under About 20 ft. of Water. Note the Exhaust Steam Escaping from the Hose

are driven to refusal, a large proportion of them reaching underlying rock. From previous borings, piles of proper length are selected, so that, in general, the tops of the piles are from two to three feet above the bottom.

The arrangement for holding the pile securely in position prior to the lowering to the bottom is novel and interesting. Two knife blades with holes drilled at their back ends are attached by means of bolts to brackets which are attached to the inside of the telescopic leads so as to swing freely up and down when not in use. When the pile is let into the leads the knives are raised until the pile has been brought up under the pile hammer, when they are dropped down against the side of the pile. Two or three blows with a sledge causes them to pierce the pile and hold it tightly in position. After the pile has been submerged the first few blows of the hammer bring the knives into tighter engagement with it, penetrating the wood to a slight extent, and then, with the further movement of the pile, the pressure is lessened and they free themselves from it and fold downward. This does not occur, however, until the pile has set itself firmly in the bottom. By using this unique method of holding the pile in the leads it has been possible to maintain exact alinement.

In the submarine driving, compressed air is introduced into the lower cylinder of the hammer to keep water from entering it and interfering with the operation of the ram. Thus the hammer runs with the same number of strokes per minute and delivers the same force of blow as it does when used in the open air. In work of the kind just described, the pressure and volume of air varies according to the depth of water. Considerable of the driving in Newark Bay is being handled with pressures of about 12 lb., a slightly less pressure being used at the start with the lesser submergence of the hammer. At depths of about 40 to 45 feet, the pressure required will be about 21 to 22 lb. and the quantity about 50 to 60 cu. ft. per min.

This work is being conducted under the direction of the engineering department of the Central of New Jersey, A. E. Owen, chief engineer. The contractor is the Henry Steers Company, New York. The steam hammer equipment was furnished by the McKiernan-Terry Drill Company, New York.

Protect the Cut-Off Ends of Your Creosoted Piles

THE photograph shows a wood-destroying fungus growing in the untreated wood exposed by cutting off the end of a creosoted pile. The end was given no protective treatment after it had been cut.

It is possible that there was slight decay in the pile before it was treated, so that cutting off the end merely

How Creosoted Piles Decay After the Ends Have Been Cut Off

allowed the fungus to fruit, or the fungus may have entered after the untreated wood was exposed. After the end of a creosoted timber is trimmed, it should be given two or three brush coats of hot creosote at once. This will hold back the growth of the fungus if it is already in the wood, or, if the wood was sound when treated, it will prevent infection afterward. *Forest Products Laboratory, U. S. Forest Service.*

The Wood-Preservers Convention in Session

Wood Preservers Discuss Economies of Timber Treatment

Service Records and Possibilities of Creosote-Petroleum Oil Mixtures Considered at Convention

THE more economical treatment of ties and other timbers by the use of a mixture of petroleum and creosote as a preservative and by the improvement of plant operation through the refinement of methods was the keynote of the papers and reports presented at the twentieth annual convention of the American Wood Preservers' Association at Kansas City on January 15-17. Among the features of special interest to railway men were comparisons of the tie renewals of a number of railways for a period of 20 years, showing the influence of treatment in increasing the life and reducing the number of ties required for renewal; the adoption of specifications for the treatment of ties and timber and the presentation of an exhaustive report on the results which have been secured to date with the use of a mixture of petroleum and creosote as a preservative.

Approximately 250 members and guests were present at the convention. In his opening address, H. R. Sackett, president of the association, and until recently assistant purchasing agent of the Chicago, Milwaukee & St. Paul, referred to the increasing necessity for uniformity in the inspection of ties and other timber products, stating that "the time is near for the association to form its own inspection bureau, membership in which shall be compulsory to all members of the Service Bureau of the Association. Furthermore, in our publicity and advertising a guarantee should be given to all materials treated by members of the Service Bureau and if advisable they should be permitted to use a designated trade mark." The report of P. R. Hicks, secretary-treasurer, showed a net increase in membership of 62 during the year and a total membership of 583.

At the concluding session of the convention the following officers were elected for the ensuing year: President, E. J. Stocking, Chicago; first vice-president, S. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe, Topeka, Kan.; second vice-president, C. F. Ford, superintendent tie and timber department, Chicago, Rock Island & Pacific, Chicago; secretary-treasurer, P. R. Hicks, secretary-manager, service bureau, American Wood Preservers' Association, Chicago, (re-elected); members of executive committee for three years, R. L. Allardyce, general superintendent, International Creosoting & Construction Company, Texarkana, Tex., and H. R. Condon, assistant forester, Pennsylvania, Philadelphia, Pa. Chicago was selected as the location for the next convention.

Report on Creosote-Petroleum Oil Mixtures

A committee of which R. S. Belcher, manager treating plants, Atchison, Topeka & Santa Fe, was chairman presented an elaborate report on the use of petroleum oil with creosote and other preservatives, of which the following is an abstract:

The addition of coal-tar to creosote oil for the purpose of treating ties has been considered good practice for some time. Its adoption on a large scale in 1908 was mainly the result of (1) a shortage of creosote oil to meet the increased requirements of the railroads in treating their ties with this kind of preservative and (2) the rapidly increasing cost of creosote oil. Results obtained from ties treated with a creosote coal-tar solution have been gratifying. They compare favorably with those obtained from ties treated with pure distillate creosote oil.

The quantity of tar now available for admixture with creosote is limited. The cost of tar is relatively high. A substitute is necessary. It must be available in large quantities. It must be cheap. It must fulfill practically the same office as does the tar in the treated tie. Viewed from this standpoint, petroleum residue of proper grade fulfills these requirements admirably in that (a) both tar and petroleum go into solution with creosote oil, (b) both tar and petroleum are stable, (c) both materials in themselves have only a limited toxicity, (d) their water-shedding qualities are similar, (e) a proper petroleum-creosote solution, like the coal-tar-creosote solution, en-

Joint Dinner of the Wood-Preservers' and Tie Producers Associations

ters readily into the timber under proper manipulation of temperature and pressure during the treating process.

A series of tests conducted at the Forest Products Laboratory, Madison, Wis., by Ernest Bateman, chemist in forest products, indicated that while petroleum-creosote mixtures are not as toxic as the same amount of creosote, this makes little difference commercially, provided mixtures containing at least 20 per cent of creosote are used, because such mixtures should be toxic enough if used in excess of six pounds per cubic foot of timber.

The committee was able to discover only a few instances of the use of petroleum oil with creosote or other preservatives in this country prior to 1923.

The most extensive test is that of the Santa Fe, which treated approximately 1,000,000 ties with a mixture of creasote and petroleum oil at its Albuquerque, N. M., plant between 1909 and 1914. All but about 100,000 of these ties were of sawn western yellow pine timber, originating in New Mexico or Arizona, and the ties were placed in track principally in western Texas, New Mexico and Arizona. Some 300,000 of these ties were given a treatment of approximately 12 lb. per cu. ft., with a mixture of 30 per cent creosote and 70 per cent Bakersfield crude oil during 1909, 1910 and 1911. In January, 1912, the treatment was changed to 7 lb. per cu. ft. of 50 per cent creosote and 50 per cent Bakersfield crude oil, applied by the Rueping process. The territory in which these ties were laid is semi-arid, the normal rainfall being 15 to 20 in. This climate is particularly severe on timber as regards splitting and brooming. The mixture-treated ties have suffered less under these conditions than either creosote or zinc treated ties, the latter suffering most of all in this respect. So far as can be ascertained, none of the mixture ties have been removed from track on account of decay, although they have been in service from 7 to 14 years, nor did a recent inspection by the committee reveal any which showed signs of decay.

Results on Santa Fe

The Santa Fe also treated, approximately, 1,000 ties with different mixtures of creosote and various petroleum oils in 1909 and 1910, placing them in track at Cleveland, Tex., for test. The annual rainfall in this section is over 50 in., while the high humidity and temperature which prevail throughout practically the entire year made wood-destroying fungi very active. These ties are installed in dirt track carrying a moderate traffic. Of a total of 815 ties inserted in this track, 31 or 3.8 per cent have been removed up to January 1, 1923. If to these removals are added such ties remaining in the track as are not sound, the total is 99 or 12.1 per cent after 11 years' service under very adverse conditions. The proportions of creosote and petroleum in the mixtures varied from one part creosote and two parts petroleum to one part creosote and four parts petroleum. The absorption of these mixtures varied with the wood and the methods of treatment. On a basis of creosote absorption alone, the average for all tests included in this summary was 2¼ lbs. per cu. ft. of timber.

The Northern Pacific began to use a mixture of equal proportions of 80-20 creosote-coal tar solution and petroleum oil for the treatment of ties at its Brainerd, Minn., plant in the fall of 1920, the mixture being injected by the Lowry process and a net retention of about three gallons per tie (7 to 8 lb. per cu. ft.) being obtained. In 1922 this process was extended to the Paradise, Mont., plant where more refractory woods are treated with a mixture of 72.7 per cent of 80-20 creosote-coal tar solution and 27.3 per cent of petroleum oil. While the Northern Pacific began placing these mixture treated ties in the track in the spring of 1921, it now has 2,122,750 in service. The present appearance of these ties is so satisfactory that the road is continuing the use of the mixture.

Crude Oil with Zinc Chloride

The committee also considered the possibility of the use of a heavy crude oil or a crude oil residuum with zinc chloride. With the amount of toxicity imparted to ties using not less than 0.5 lb. of zinc chloride per cu. ft., together with sufficient crude oil residuum to prevent leaching, the committee is of the opinion that it is quite possible to prolong the life of ties thus treated so that their results in track will be much better than now obtained from zinc chloride alone for it is known from ties in service that less than one-half pound per cu. ft. of zinc chloride will kill fungi organisms.

The Southern Pacific treated 115,000 loblolly pine ties with zinc chloride, followed by crude oil in 1914. The ties were treated to refusal, receiving about 0.25 lb. of dry salt per cu. ft. After being stacked in open cribs in a yard to season for three to six months, these ties were retreated with Mexican Panuco crude oil, retaining 8 to 12 lb. per cu. ft. On a recent inspection few of these ties were found decayed and these had been badly mutilated or broken. H. M. Lull, chief engineer of these lines, estimates that these ties will give about ten years' average life.

At the present time the Atchison, Topeka & Santa Fe, the International-Great Northern, the Philadelphia &

Reading, and the St. Louis-San Francisco are using ties treated with one or more of the following quantities and mixtures of preservatives:

Final Retention Pound per cu. ft.	Creosote Per Cent	Petroleum Per Cent
8	72.7	27.3
7	70.0	30.0
7	50.0	50.0
8	30.0	70.0

Conclusions

1. Creosote for mixture with petroleum oil shall be any of this Association's standard grades of creosote and creosote-coal-tar solution for ties and structural timbers.

Hewed Texas Pine Ties Treated with Five Pounds per Cubic Foot of Creosote by the Rueping Process

2. (a) The petroleum oil used should preferably be of asphalt base, but an oil of mixed paraffin and asphalt base may be used where such an oil is found which mixes with creosote in the required proportions without formation of more than 1½ per cent of sediment.

(b) The specific gravity of the petroleum oil is not important.

Sawed New Mexico Pine Ties Treated with 12 Pounds Per Cubic Foot of a Mixture of 31 Per Cent Creosote and 70 Per Cent Bakersfield Oil Showing the Condition After 10 Years' Service

(c) The minimum flash point of the petroleum oil in closed tester should be 225 deg. F.

(d) The maximum viscosity of the petroleum oil should be such that when mixed with creosote in the desired proportions at treating temperature the mixture will readily penetrate the wood. (A satisfactory penetration at 180 deg. F. and 175 lb. pressure has been obtained with a mixture having a specific viscosity of 1.5 Engler.)

3. The percentage each of creosote and petroleum oil in the mixture and the final retention of mixture per cu. ft. of timber is a matter best left to the individual railroads or treating companies. In making decision as to this, climate, kind of woods to be treated, method of treatment used, etc., should be considered.

4. Petroleum oil adds to the *mechanical* life of a tie by retarding or preventing checking and splitting of the wood.

5. A creosote-petroleum oil mixture, made up of grades of creosote and petroleum oil as indicated in the above and containing sufficient creosote to prevent decay of the wood, is an economical and satisfactory preservative.

6. The results obtained from zinc chloride-petroleum treated ties show that the addition of petroleum to the zinc chloride treatment will under most conditions add to the service which is obtainable from the use of straight zinc chloride only.

Discussion

In discussing this report, C. M. Taylor, superintendent timber preservation, Philadelphia & Reading, emphasized the fact that timber preservation, as evidenced by this report, is no longer to be considered solely as a protection against decay but is also found to protect the timber from shattering and similar forms of mechanical destruction. He expressed the opinion that the use of this mixture of oil for timber preservation was no longer to be regarded as experimental.

Zinc Chloride as a Wood Preservative

During the course of the convention Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, Mo., presented a brief statement of the status of zinc chloride as a timber preservative, in which he spoke in part as follows:

As a result of numerous failures more attention is now being paid to zinc chloride than ever before. I feel that it has a large place in the wood preserving industry in this country, particularly when we take the more or less modern viewpoint that the financial risk which we take in making the investment is the controlling feature. The risk which we take in preserving timber must be viewed not only from the preservative angle, but also from the mechanical service of the material as well. Regarded from that viewpoint, the cheapness in the initial investment with zinc chloride is an important factor, particularly when we can at least double the life of ties by its proper use. Naturally, we all want the best and if we could get creosote we probably would all use it for the impregnation of our timber, but that is not possible and we also have to use other preservatives. Past experience with zinc chloride clearly indicates that in its use more careful chemical and physical control must be exercised, not only with the solution and the treating process but also the subsequent handling of the material.

A number of developments have occurred during the past year which bring zinc chloride into a more favorable light. F. S. Pooler, of the C. M. & St. P., has made the flat-footed statement that zinc chloride ties have been in actual service on that road for 20 years and on a recent inspection these ties look as if they had been laid yesterday. The study of solution temperatures which has been made during the past year may be another index of progress in getting better service from zinc chloride. Last but not least, the possibility of adding petroleum to zinc chloride may be a still further step in extending the life of zinc chloride treated ties. No one who looked at

the ties in the Santa Fe or Southern Pacific tracks could help but be impressed with the remarkable appearance of the zinc ties treated with petroleum subsequently.

There is a revival of interest at the present time in the possibility of the more economical utilization of wood in car construction. Judging by the inquiries which have come to my office during the last six or eight months regarding the possibilities of treating sills and other portions of the car that have to be painted, this construction offers a field for thought for those interested in the proper application of preserved wood. Objections have been made that zinc chloride might stain paint, but experimental panels which we painted both red and white and put up a little over two years ago looked as good at our last inspection as the day we put them up.

Committee on Track Service Records

The Committee on Track Service Records, of which Z. M. Briggs, assistant engineer maintenance, Central region, Pennsylvania System, is chairman, presented tabulations showing the number of ties used in renewals per mile of track on 15 roads since they began the extensive use of treated ties, these renewals being summarized in the table at the bottom of the page.

The committee also submitted progress reports of special test tracks on the Chicago, Burlington & Quincy; the Baltimore & Ohio; the Union Pacific and the Chicago, Milwaukee & St. Paul, which are also published below

Chicago, Burlington & Quincy

1000 ties laid out of face on each of 20 divisions, 1909-10. Result of 1922 Inspection—(13 years' service.)

Treatment	Total Placed	Removed to date	Removed account delay	Removed for other causes
Lines East (moderate rainfall)	Number	Number	Per Cent	Per Cent
Creosote (Full-Cell—10 lb.)	2027	140	2.8	4.1
Zinc—Creosote (Card) a...	10259	2003	5.9	13.6
Zinc—Chloride (½ lb.).....	1584	526	19.0	14.2
Total treated.....	13870	....	....	....
Untreated	2040	1963	88.9	7.3
Lines West (light rainfall)				
Creosote (Full-Cell)	1117	107	0.7	8.8
Zinc—Creosote (Card)	4929	1099	5.9	16.4
Zinc Chloride	842	273	9.5	22.9
Total treated	6888	....	....	....
Untreated	1075	1035	89.4	6.9

(a)—½ lb. zinc and 3 lbs. creosote per cu. ft.

Baltimore & Ohio

Windsor-Blanchester Test (East of Cincinnati)
Ties placed March, 1911. Report for 1922
Traffic, 5,113,000 tons annually. Rainfall, 40 in.

Treatment	Total placed	Removed to date	Removed
	Number	Number	Per Cent
Untreated White Oak.....	757	556	73.4
Card process—(2 lb. creosote, ½ lb. zinc chloride).....	2344	262	11.2
Coal-Tar Creosote—(5.7 lb.)....	1125	27	2.4
Timber Asphalt—(Open Tank Process—6.9 lb.) (984 Red Oak, 17 Elm, etc.).....	1001	742	74.1

Union Pacific

Dodson, Oregon. Annual rainfall, 70 in.
Douglas Fir ties placed in test track August, 1908

Treatment	Total placed	Removed to date	Removed
	Number	Number	Per Cent
Sawed ties, well seasoned. ¼ lb. zinc chloride. Piled with ½ in. strips for 30 days before using	977	408	42
Sawed ties, not seasoned. ¼ lb. zinc chloride. Shipped as treated	975	655	67
Hewn ties, well seasoned. ¼ lb. zinc chloride	1969	796	40
Sawed ties, 8 lb. creosote.....	1000	17	2
Sawed ties, Carbolineum open-tank, 150 deg. F. for 30 min.	300	262	87
Sawed ties, Spaulding Process (1909)	250	222	89
Sawed green ties, not treated, from mill direct to track.....	1007	912	91
Sawed ties, well seasoned, untreated	1006	886	88

Chicago, Milwaukee & St. Paul

Treatment	Year placed	Total placed	Removed to date	Removed
		Number	Number	Per Cent
Zinc—Creosote (Card)				
(½ lb. Zinc—2 lb. Creo.)	1908	596	86	14
(½ lb. Zinc—2 lb. Creo.)	1910	1649	872	53
Zinc Chloride (½ lb.)....	1903	500	213	43
Zinc Chloride (½ lb.)....	1906	1296	285	22
Zinc Chloride (½ lb.)....	1911	676	320	47
Zinc Chloride (½ lb.)....	1913	805	104	13
Untreated White Oak.....	1911	355	291	82
Untreated Longleaf Pine..	1908	1375	1224	89
Untreated Cedar.....	1902	500	400	80
Untreated Fir and Larch..	1912	338	168	50

Report of Committee on Preservatives

The Committee on Preservatives, of which Ernest Bateman, chemist in forest products, Forest Products Laboratory, Madison, Wis., was chairman, recommended that the association adopt as standard the specifications for Grades 2 and 3 creosote for ties and structural timber, these specifications being the same as those adopted for open tank treatment in 1922. These specifications are as follows:

Specification for Grade 2 Creosote Oil for Ties and Structural Timber

1. The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:
2. It shall not contain more than 3 per cent of water.
3. It shall not contain more than 0.5 per cent of matter insoluble in benzol.
4. The specific gravity of the oil at 38 deg. C., compared with water at 15.5 deg. C., shall not be less than 1.03.
5. The distillate, based on water free oil, shall be within the following limits:
   Up to 210 deg. C., not more than 8 per cent.
   Up to 235 deg. C., not more than 35 per cent.
6. The residue above 355 deg., if it exceeds 5 per cent, shall have a float test of not more than 50 sec. at 70 deg. C.
7. The oil shall yield not more than 2 per cent coke residue.
8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

Average Annual Cross Tie Renewals

Year	A. T. & S. F.	B. & O.	C. B. & Q.	C. M. & St. P.	C. R. I. & P.	C. C. C. & St. L.	D. L. & W.	I. C.	K. C. S.	M. C.	N. Y. C. East	N. Y. C. West	N. P.	Penna.	U. P.
1901-1905	228	222	...	157	...	...	235	...	...	210	213	...	303	252	245
1906-1910	272	249	...	158	...	310	229	...	...	168	227	257	293	230	294
1911-1915	216	254	...	181	237	307	254	272	357	283	244	273	294	265	227
1916-1920	160	248	186	200	182	195	156	203	276	210	193	233	246	198	206
1921	148	229	177	161	169	194	166	...	311	154	222	196	231	228	184
1922	158	206	167	188	151	143	137	...	...	222	208	196	167	225	203

Specifications for Grade 3 Creosote Oil for Ties and Structural Timber

1. The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall not contain more than 3 per cent of water.

3. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

4. The specific gravity of the oil at 38 deg. C., compared with water at 15.5 deg. C., shall not be less than 1.03.

5. The distillate, based on water free oil, shall be within the following limits:

Up to 210 deg. C., not more than 10 per cent.
Up to 235 deg. C., not more than 40 per cent.

6. The residue above 355 deg. C., if it exceeds 5 per cent, shall have a float test of not more than 50 sec. at 70 deg. C.

7. The oil shall yield not more than 2 per cent coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood-Preservers' Association.

The committee also presented specifications for water-gas tar products for use with zinc chloride and for high boiling oils for brush or spray treatment. The latter follows:

Standard Specifications for High Boiling or Anthracite Oils for Brush or Spray Treatment

1. The oil shall be a pure distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

2. It shall be fluid at 15 deg. C., and crystal-free at 38 deg. C.

3. It shall not contain more than 1 per cent of water.

4. It shall not contain more than 0.5 per cent of matter insoluble in benzol.

5. The specific gravity of the oil at 38 deg. C., compared with water at 15.5 deg. C., shall not be less than 1.09 nor more than 1.13.

6. The distillate, based on water-free oil, shall be within the following limits:

Up to 235 deg. C., not more than 2½ per cent.
Between 235 deg. C., and 300 deg. C., not more than 20 per cent.
Up to 355 deg. C., not less than 50 per cent.

7. The residue above 355 deg. C., if it exceeds 35 per cent, shall have a float test of not more than 50 sec. at 70 deg. C.

8. The oil shall yield not more than 2 per cent coke residue.

9. The foregoing tests shall be made in accordance with the standard tests of the American Wood-Preservers' Association except the distillation test which shall be made by the method hereto described.

In addition to the above requirements the following are sometimes deemed advantageous:

A. The flash point by the Cleveland open-cup tester shall not be less than 120 deg. C.
B. The fire point by the Cleveland open-cup tester shall not be less than 165 deg. C.
C. The tar acids as determined by the contraction method of the Association shall not exceed 3 per cent by volume of the total oil.

All of these specifications were adopted by the Association.

Report on the Treatment of Ties

The Committee on the Treatment of Ties, of which J. R. Helson, superintendent, Watkins Creosoting Company, was chairman, presented specifications for the preservative treatment of ties other than Douglas fir, larch or tamarack by pressure processes as follows:

General Requirements

1. The following general requirements (2-8) apply to each of the treatment processes.

2. **Conditioning.** Ties shall be conditioned for treatment in accordance with American Wood-Preservers' Association "Standards for the Purchase and Preservation of Treatable Timber."

3. **Seasoning.** (a) Ties shall be seasoned, by air or steam as agreed upon, until in the judgment of the purchaser's representative any moisture in the wood will not prevent the injection and proper distribution of the specified amount of preservative.

(b) When, in the judgment of the purchaser's representative, steam-seasoning is necessary for adequate treatment, cross-ties may be steamed in the cylinder at not more than 30 lb. pressure per sq. in. for not more than 10 hr. at not more than 274 deg. F., which pressure and temperature maxima shall not be reached in less than two hours. The cylinder shall be provided with vents to relieve it of air and insure proper circulation of steam. After steaming is completed a vacuum shall be maintained at a temperature as high as practicable until the wood is dry as practicable. The cylinder shall be relieved continuously or frequently enough to prevent condensate from accumulating in sufficient quantity to reach the wood. Before the preservative is introduced the cylinder shall be drained of condensate.

4. **Preparation for Treatment.** Any charge of ties shall be confined to one kind or designated group or kinds of wood, of pieces approximately equal in size and moisture and sapwood content, into which approximately equal quantities of preservative can be injected, on which all necessary framing boring, or chamfering shall have been done where possible, and so separated as to insure contact of preservative, and steam if used, with all surfaces.

5. **Manner of Treatment.** The ranges of pressure, temperature, and time duration shall be controlled so as to result in maximum penetration by the quantity of preservative injected, which shall permeate all of the sapwood, and as much of the heartwood as practicable. The vacuum requirements stipulated are those at sea-level, and necessary corrections shall be made for altitude.

6. **Retention of Preservative.** No charge shall contain less than 95 per cent nor more than 110 per cent, of the quantity of preservative that may be specified. The amount of preservative retained shall be calculated on the basis of preservative at 100 deg. F., from readings of working-tank gauges, or scales, or from weights before and after treatment of at least one-fifth of the number of loaded trams on suitable track scales, checked as may be desired by the purchaser's representative.

7. **Determination of Penetration.** Penetration shall be determined by sampling ties in each charge, as may be desired by the purchaser's representative. Any holes which may be bored shall be filled with tight-fitting treated plugs.

8. **Plant Equipment.** Treating plants shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in condition satisfactory to the purchaser. The apparatus and chemicals necessary for making the analyses and tests required by the purchaser shall also be provided by plant operators, and kept in condition for use at all times.

Preservatives

9. The preservative or preservatives used shall be the most suitable and available of the following standards of the American Wood-Preservers' Association as stipulated:

Creosote Oil (Grade 1) for Ties and Structural Timber.
Creosote Oil (Grade 2) for Ties and Structural Timber.
Creosote-Coal-Tar Solution for Ties and Structural Timber.
Creosote Oil (Grade 3) for Ties and Structural Timber.
Zinc Chloride.
Water-Gas-Tar Solution for Admixture with Zinc Chloride.
Water-Gas-Tar Distillate for Admixture with Zinc Chloride.

Amount of Preservatives to Be Used

10. Creosote:
Full-cell process, not less than 10 lb. per cu. ft. of cross-ties.
Empty-cell process, without initial air, not less than 5 lb. per cu. ft. of cross-ties.
Empty-cell process, with initial air, not less than 5 lb. per cu. ft. of ties.
Zinc Chloride:
Not less than ½ lb. dry salt per cu. ft. of ties.
Creosote-Zinc Chloride:
Not less than 2 lb. of oil and ½ lb. of dry salt per cu. ft. of ties.

The specifications concluded with detailed instructions regarding the manner of injection of the preservative according to the different processes.

Other Reports

Other subjects which were considered at the convention in addition to those referred to briefly below, were the inspection of the preservative treatment of wood and the treatment of posts.

Report on Steam Treatments

The Committee on Steam Treatments sent a questionnaire to 70 companies operating pressure treating plants, from which 47 replies were received covering the practices at 77 plants. Of these, 32 do not steam any material and 4 steam only when steaming is required. Of the 41 plants from which data were obtained on the steam pressure used, 16 specified 20 lb. for all material, 6 used pressures varying from 10 to 20 lb., 8 used from 20 to 30 lb. and 6 used pressures up to 35 to 40 lb.

It is evident from the replies received that preliminary steaming is widely used, especially in the treatment of green or partially green timber. There is, however, no agreement in regard to the most suitable steam pressure to use or in the length of steaming period required for a given class of material. It is not unusual to find different plants treating the same kind of material and yet using widely varying steaming conditions. Doubtless steaming could be omitted in some cases where it is now used without decreasing the effectiveness of the treatment. In other cases the steaming period may be too long or too short to give the best results.

Tests made at the Forest Products Laboratory showed that a steaming and vacuum treatment increases the moisture content of seasoned material and reduces the moisture content of green or wet material. However, even long continued steaming and vacuum treatments fail to season green timber completely.

The Treatment of Poles

Two reports were presented on the treatment of poles, one by pressure and the other by non-pressure processes. The report of the Committee on Pressure Treatments described the conditions found in an inspection of a pole line between Kansas City, Mo., and Olathe, Kan., installed in 1920 and the plans made to observe the service rendered by these poles from year to year. The committee also submitted specifications for the treatment of poles by pressure processes which were adopted by the association.

The Committee on Non-Pressure Treatment of Poles has also had a number of sections of pole lines under observation for 30 months, as a result of which it has drawn the following conclusions: (1) That the perforation treatment not only prevents harmful checking, but closes to a very marked degree checks which were in the timber at time of treating. (2) That the non-perforation treatment does not prevent checking in green timber, but lessens the checking in partially seasoned or seasoned timber. (3) That the perforation without the treatment lessens checking to a greater extent than the non-perforation treatment. From these facts it is evident that the perforations and the deep saturation of creosote are both factors in preventing checking. The perforations relieve the stresses causing the checks, and the deep saturation of the oil provides an insulation against rapid seasoning which is an element causing checking.

Relation Between Temperature and Penetration of Zinc Chloride

The results of a series of experiments made at the Forest Products Laboratory, Madison, Wis., and at the Union Pacific treating plant at Laramie, Wyo., to determine the relation of temperature and pressure to the absorption and penetration of zinc chloride solution into wood, was presented by J. D. MacLean, engineer in forest products, Forest Products Laboratory. These experiments indicated that the use of high temperatures will not only result in better treatment, but will bring about considerable savings in the cost of operation by shortening the time of treatment or by eliminating steaming. However, pressures of about 140 lb. to 150 lb. are apparently the maximum that should be used with a solution temperature of 200 deg. F., in treating timbers of tie size. A combination of 175 lb. pressure and 175 deg. F., or a combination of 170 lb. pressure and 185 deg. F., gave satisfactory results. Although long steaming caused serious checking in the heart lodgepole pine, none of the ties treated in these experiments appeared to be injured by the other treating conditions.

The Treatment of Timber

The Committee on the Treatment of Timber, of which H. R. Condon, assistant forester, Pennsylvania System, was chairman, prepared specifications for the preservative treatment of timber by pressure processes which were the same as those for the treatment of ties, with two exceptions. Paragraph 3b increases the permissible limits of steaming to 20 hrs. and requires the steaming to be followed by a minimum vacuum of 22 in. Paragraph six is revised to eliminate the words "at least one-fifth of the number of" in the last sentence.

A report on the Treatment of Douglas Fir Ties described the difficulty of treating this timber because of the fact that it is nearly 100 per cent heartwood and this wood is of a hard and generally dense fiber. The experiments which have been made to develop a satisfactory means of treating this timber, including the puncturing process, were described. The committee concluded its report with the statement that it was not prepared to offer any recommendation covering the treatment of Douglas fir in any form at this time, as it believed that the last word in the treatment of this timber has not yet been said.

Visible Test for Sodium Fluoride

A paper was presented by George T. Parker and H. A. Geauque, of Lombard College, Galesburg, Ill., describing a method which has been developed to determine the penetration of sodium fluoride in treated wood visually. The test which has been found to be most satisfactory is as follows:

First. The surface of the wood to be tested is sprayed with a 5 per cent solution of potassium ferricyanide and dried.

Second. The surface is then sprayed with a 5 per cent solution of iron ammonium chloride.

As soon as the line dividing the treated and the untreated portions appears, the surface of the wood is washed thoroughly with tap water. The test should be performed in ordinary daylight, not direct sunlight. The untreated part of the wood is colored a deep blue and the color of the treated portion is not changed. It generally takes about three or four seconds for the line to appear and the test works equally well on pine, oak, or fir, woods with widely divergent qualities.

CANADIAN NATIONAL EARNINGS—The Canadian National Railways, according to the president, Sir Henry Thornton, earned in 1923 net revenues of $20,127,447, as compared with $2,480,512 in 1922. These figures are preliminary and may be slightly changed later. Operating revenues in 1923 amounted to $254,662,447, an increase of $21,005,559 over 1922, and operating expenses rose $3,358,624 over the 1922 total, which was $231,176,376.

Two Railroads Find Water Pipe Cleaning Profitable

Novel Methods Feature Work Undertaken by Northern Pacific and Rock Island to Remove Incrustation

THE EXTENSIVE adoption of water treatment by the railroads in this country has been marked by accomplishments affecting the operation and upkeep of locomotives which readily explain its growth and the widespread interest taken in it, but water treatment has not been introduced without creating new problems, notably the incrusting of pipe lines handling the treated water. As a result of this incrusting trouble most railroads engaged in water treatment have had occasion to concern themselves with the cleaning of incrusted pipe. This is borne out by the work recently prosecuted by the Northern Pacific and the Chicago, Rock Island & Pacific. At about the same time these roads undertook to remove from certain water supply lines incrusted material which had accumulated to such a depth as seriously to impair or to destroy their serviceability. The results obtained are presented in the following accounts of the work done.

Northern Pacific Pipe Cleaned in Place

By E. M. GRIME,
Supervisor of Bridges and Buildings, Northern Pacific, Fargo, N. D.

The pipe cleaning work undertaken by the Northern Pacific involved 17,456 ft. of 10-in. line extending from the pump house and intermittent treating plant at Gantz, Minn., to Dilworth, a terminal point on the main line. Dilworth requires 300,000 to 500,000 gal. of treated water per 24 hrs., depending on business conditions. In the spring of 1923 the pipe line through which this supply was obtained had become incrusted to such an extent that unless remedial measures were taken, by winter it would not have been possible to pump a proper supply of water for Dilworth through this line.

Conditions regarding storage and the use of water at Dilworth are such that it is not advisable to have the Gantz pump out of service longer than two or three hours at a time. The problem confronting the engineering department, therefore, was to clean this line without interfering with the pumping operations for a longer period.

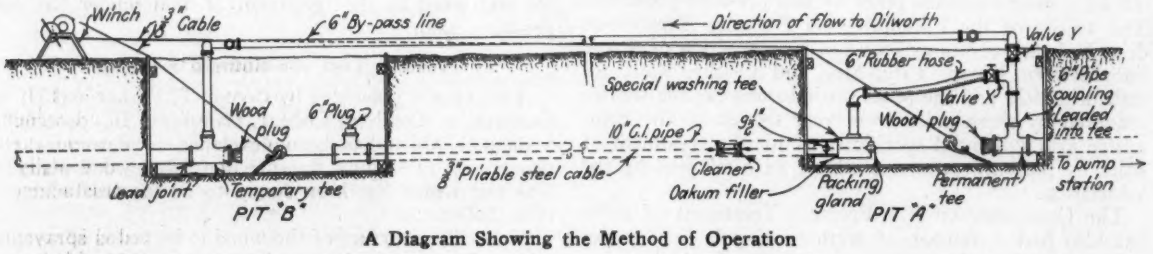
When it first became necessary to clean this line some years ago pits 8 ft. wide by 16 ft. long were excavated at intervals of 600 ft. along the line. Each pit was lined with the same material, the floor being about 8 in. below the pipe line to allow space for calking the joints. With the exception of four new pits which were required at the far end of the pipe line, where cleaning had not previously been necessary, all the pits were found in sufficiently good condition so that, with the exception of some new bracing, it was only necessary to excavate the earth filling in order to start the work. In most of these pits 12 ft. of the pipe line had been replaced by a 10-in. by 10-in. by 6-in. cast tee and two short lengths of pipe and a sleeve. The cast tee has a 6-in. wrought pipe coupling leaded into the 6-in. outlet and a cast 6-in. cap screwed into this coupling.

Description of the Work

The method of doing the work is illustrated by the drawing which is explained as follows:

The six-inch wrought pipe overland by-pass line having been laid between two adjacent pits, the pumps are closed down and the by-pass connected up using a 6-in. flexible hose connection at each end to avoid trouble in making tight joints. The open end of the permanent 10-in. tee in pit A is closed by means of a wooden plug, as is also the open end of the temporary tee at pit B, which is leaded to the main pipe. Removing the short sections of pipe in each pit, so as to be ready for cleaning, involved the burning out with an oxy-acetylene torch of four lead joints at pit A and the same at pit B with the additional work of leading one joint.

A line of sewer rods having couplings that can only be disconnected when at right angles with each other is then pushed through this 600 ft. section of pipe by hand and with it a ⅜-in. steel cable is drawn through.



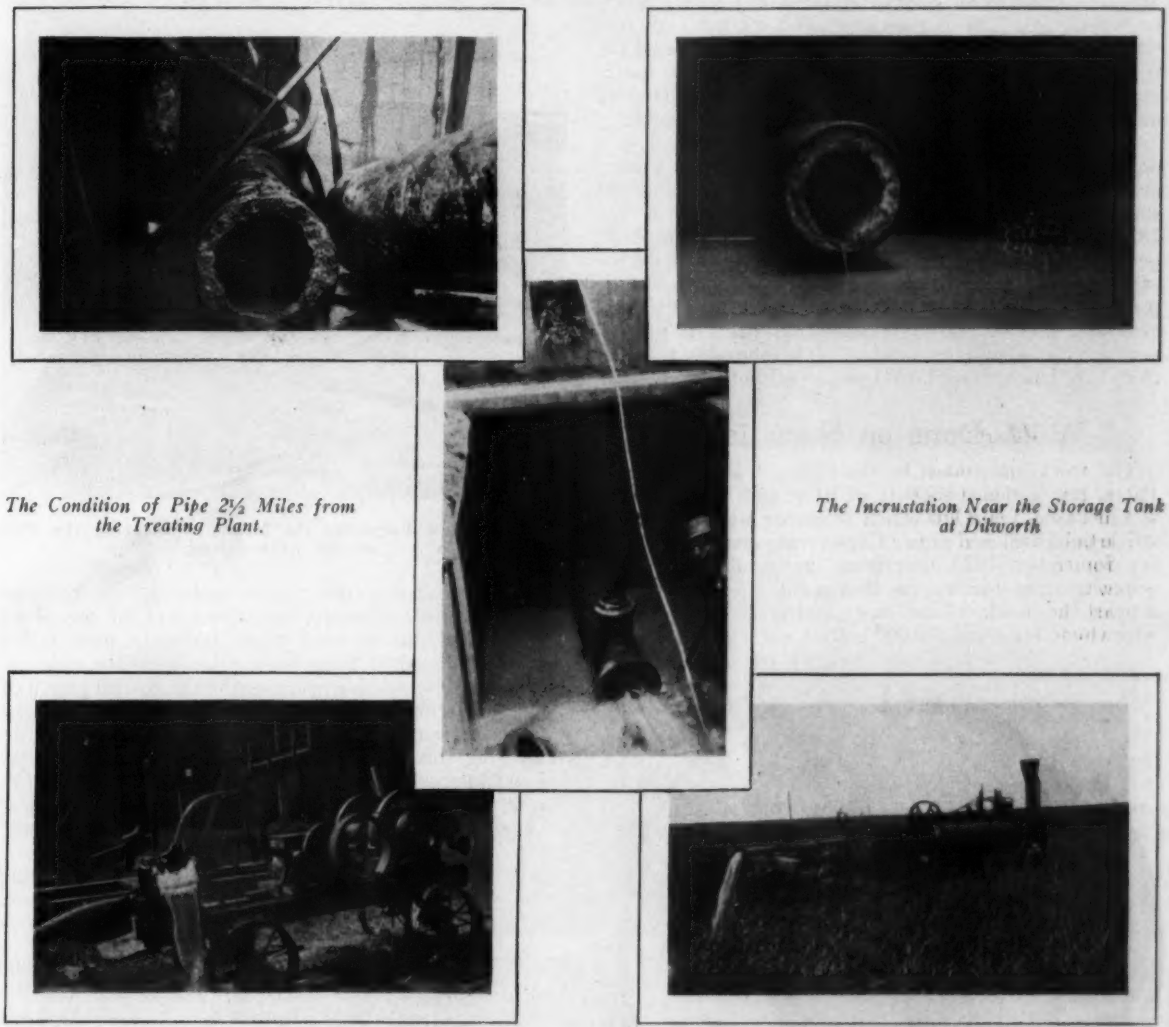
A Diagram Showing the Method of Operation

This cable is about 1,400 ft. long. When the further end has been pulled through to pit A, a special type of large size flue cleaner of the diameter thought necessary, considering the thickness of the incrustation in this section of the pipe, is attached to the cable. The cable has been given three turns around the drum of the winch which is located near pit B and the other end is then brought to pit A, passed over a sheave wheel and back through the packing gland of the special tee and then secured to the other end of the cleaner. The special tee is then connected to the end of the 10-in. pipe in pit A by means of a 9½-in. length of wrought pipe. This is moved into the end of the pipe and crowded up tight so that with a ring of oakum in the joint there is no great leakage. After this special tee is blocked in place water pressure from the main pumping line is turned on back of the cleaner by opening valve X, valve Y being partially closed if necessary in order to secure sufficient pressure, and three men on the winch located near pit B put a strain on the cable. Should the cleaner become jammed the water pressure is removed by closing valve

X and the operation of the winch reversed so as to drag the cleaner back. Then by again applying the water pressure the obstruction can usually be washed forward. If not, a smaller size cleaner must be substituted. The water scours out between the pipe and the wings of the cleaner as it moves forward and also carries the loosened scale through to pit B. If the incrustation is hard and thick the operation is repeated as described above with a larger cleaner, followed, if necessary, with steel wire brushes so as to leave the pipe perfectly clean. The

Labor of water service foremen and helpers	$4,960.92
Curbing new holes and repairing old curbing	69.45
Coal used in operating centrifugal pump	89.90
Gasoline used by small gas engine operating diaphragm pump and for motor car transporting men and material	27.03
Lead, lubricating oil, oxygen, pipe fittings, etc	419.55
	$5,566.85

The unusually low cost of the pipe cleaning work and its successful prosecution were promoted by a number of measures which were taken preparatory to starting.



The Condition of Pipe 2½ Miles from the Treating Plant.

The Incrustation Near the Storage Tank at Dilworth

Views of the Pipe Cleaning Work Done on the Northern Pacific

Left—The Home Made Pumping Outfit That Saved $650. Center—The Cleaner Emerging from the Line. Right—The Tractor Which Saved $2,000

water and scale is removed by means of a 6-in. direct-connected, centrifugal steam-operated pump. The water which leaks past the packing gland at pit A is removed by means of a diaphragm pump.

The Work Cost Only 31.8 Cents Per Foot

The cleaning of the pipe line was accomplished in 91 working days without a single failure of the water supply at the Dilworth terminal. The actual cost of the work was 3.4 cents per foot for material and supplies and 28.4 cents for labor, or a total of 31.8 cents per foot, distributed as follows:

One scheme employed was to connect up the diaphragm pump with a small gasoline engine and to mount this equipment on wheels. By this means the diaphragm pump was kept in continuous operation without other attention than that given by the foreman in charge, thus saving the labor of three men otherwise required to operate the pump during four days of each week for the 15 weeks in which the work was in progress. Expressed in dollars, this was a net saving of $653.37.

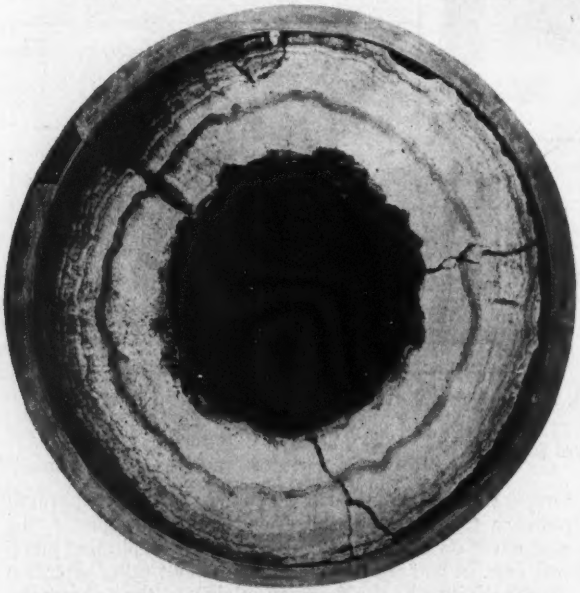
Another expedient was the employment of a 25-hp. Rumley steam tractor which was purchased for $750. This tractor was used to furnish steam to operate the

centrifugal pump and for moving this equipment and also the six-inch by-pass line from one hole to the next. Without this engine it would have been necessary to use a hoisting engine and to move all the equipment by means of block and tackle. To move a hoisting engine would have required the labor of the entire force 1½ days at an average expense of $78 for each of the 28 moves. By using the tractor engine each move required only one hour for the entire force or an expense of but $6.50. This is equivalent to a saving of $71.50 for each move, or a gross saving of $2,002 by the use of the traction engine alone. The engine consumed 12 tons of coal which cost $89.90, leaving a net saving by the use of the traction engine of $1,912.10. The tractor was also useful inasmuch as it permitted the work to be completed 42 days sooner than would otherwise have been possible.

The entire line was almost uniformly incrusted to a depth of two inches, leaving only a six-inch opening available. In consequence of this, when the cleaning was started the Gantz pumps were pumping to Dilworth only 18,000 gal. per hour at a working pressure of 65 to 70 lb. per sq. in. while since the cleaning has been completed the same pumps handle 26,300 gal. per hour with a maximum pressure of only 45 lb. The pumps are electrically operated and this decreased pressure has made a marked saving in current consumption. The actual saving for electricity has averaged $104 per month.

Work Done on Rock Island

The work undertaken by the Chicago, Rock Island & Pacific involved about 300 ft. of 10-in. and 12-in. pipe line at Chickasha, Okla., to which reference was made in an article published in *Railway Engineering and Maintenance* for September, 1923, describing the installation of new water treating facilities at that point. As told in that article, the Rock Island has a terminal at Chickasha which requires some 250,000 gal. of water per day. The



The 10-in. Pipe Was So Badly Incrusted That It Was Taken Up

water reaches the terminal through about 5,000 ft. of six-inch cast iron pipe after treatment in an intermittent plant. This pipe line discharged into a stand pipe from which 10-in. and 12-in. cast iron lines carried the water to two water columns for locomotive service. The water in the natural state was a hard water containing an average of about 39 grains of incrusting solids but subject to constant variation. The capacity of the old intermittent plant was outgrown and to make matters worse the water was being obtained in varying proportions from two different sources.

As a result of these conditions, matter which should have been removed at the treating plant was continually being carried into the distributing system where much of it settled, forming a hard scale on the interior of the pipe line. In 1919, the 5,000 ft. of six-inch line was so badly

A Drum Hoist Furnished the Means of Cleaning the Pipe on the Rock Island

limed up that it was taken up and replaced. Shortly after July, 1922, while adjusting the operation of the new plant, it was found that as much as six inches of incrustation had accumulated in these lines, prolonging the time required to fill locomotive tenders from the normal period of from 3 to 5 min. to from 15 to 20 min. The extent of the incrustation is shown in one of the illustrations. In remedying this situation it was deemed best to take up the old line, whereupon the pipe was cleaned in the following manner, as described by F. T. Beckett, engineer maintenance of way of the Second district, El Reno, Okla.:

The method adopted was to use a small steam hoisting engine after the manner of a boring machine or reamer. With the aid of a flange coupling a length of four-inch wrought pipe was securely fastened to the winch head of the hoisting engine, bolting through holes drilled in the end of the head. This placed the pipe in line with the axis of the winch so that when the hoist was operated this pipe could serve as a revolving spindle that could be passed inside of the pipe to be cleaned. A short piece of chain fastened to the end of the spindle pipe did the work. As each piece of incrusted pipe was slowly telescoped over the revolving spindle, this chain efficiently scraped the interior of the pipe. The heavy sections were hauled on a push car to which the pipe was securely fastened by a clamp and the car was operated to and from the hoist on a light temporary track, as illustrated.

The work was performed at a cost of only $91 or $394 less than the value of the pipe. This saving of $394 was at the rate of approximately $1.20 per lin. ft. In 1919, 2,622 ft. of the 5,000 ft. of six-inch cast iron pipe taken up was cleaned by this method at a total cost of $314.64 or at the rate of 12 cents per lin. ft. as compared with the prevailing price of 82 cents per lin. ft. for new six-inch cast iron pipe.

WHAT THE EARTHQUAKE DID TO THE JAPANESE RAILWAYS

1—Cracking and Shifting of Piers of Bridge Over Minato River, Between Kazusa-Minato and Hama-Kanaya, Boso Line. 2—Cracking and Partial Falling of Nokogiriyama Tunnel, Sobu Line. 3—Falling of Girders on Bridge Between Hayakawa and Nebukawa, Atami Line. 4—Eastern Entrance of Komine Tunnel after the Quake. 5—Looking Over Bridge Shown in First Illustration. 6—Derailed and Overturned Passenger Train Near Oiso Station, Tokaido Line. 7—Overturned Locomotives, in Engine House, Awahojo Station, Sobu Line. 8—Shifting of Roadbed Leaving Track in Original Position, Between Nebukawa and Manazuru, Atami Line. 9—Shimbashi Station, Tokyo. 10—Overturned Freight Train Chigasaki Station Yard, Tokaido Line. 11—Collapsed Bridge Over Banyu River, Tokaido Line. 12—Passenger Train Buried When Samunomeyama Tunnel Collapsed During the Quake; Stack and Cab of Locomotive Barely Visible. 13—Train Crushed and Overturned by Falling Bridge.

How Can We Develop Good Foremen?

Concluding Papers in the Contest on the Selection and Training of These Important Men in the Track Organization

FEW SUBJECTS discussed in the pages of *Railway Engineering and Maintenance* have elicited more interest than that relating to the training of section foremen. This matter was handled in the form of a contest announced in an editorial appearing in the issue of September, 1923. The names of the prize winners were given in the November issue, in which their papers and those of three other contributors were published. Further contributions were presented in the issues of December and January, while brief abstracts of several of the remaining papers appear below. Altogether, 43 discussions of this subject were received. To avoid undue repetition it has been deemed advisable to close the subject in this issue, although this makes it necessary to withhold from publication a number of contributions which clearly deserved commendation.

The Motor Car Has Exerted an Important Influence in Retaining Good Men in the Track Forces

How One Foreman Trains Men

By L. GARCIA,
Section Foreman, New York Central, Clark Mills, N. Y.

Any man with proper ability should be able to gather enough experience in three years as a track laborer to be promoted to section foreman. When I put a new man at work, the first month I show him in a kindly way how to do things; the next two months I study him and if I see any ability in him, I begin to talk to him about the rules and tell him to watch how I do my work. The first year I keep him steadily at work with the gang; the second I keep him with me on special work around switches, crossings, etc. The third year I show him how to raise and line tracks, starting with side tracks first and also show him how to make reports and have him study the book of rules. I sometimes place him in charge of the gang alone while I watch him from behind the fence, criticizing anything that is not done right.

Give the Man a Well Rounded Experience

By ARTHUR JUNG,
Roadmaster, Union Pacific, Grand Island, Neb.

A prospective foreman should be from 21 to 31 years of age, American or English speaking, of good character and should be able to pass the physical examination. He should preferably have a high school education, not be afraid of work, or above taking advice and instructions, and should be inclined to watch line and surface instead of the clock. When a man of this description has been found, place him with one of the best foremen until he has learned his method of doing work and then transfer him to another competent foreman. This mey be repeated several times so that the man can acquire the combined experience of the better foremen. Later, he should be put in extra gangs, especially one laying rail so that he will learn to handle large forces men.

After serving in extra gangs he should be put on yard work where he will have an opportunity to become familiar with the different switches, slips, etc., and also learn how work is done in the shortest time. Last, but not least, he should fill the place of timekeeper to learn how properly to keep time and distribute material and labor charges.

The amount of experience a man should have before promotion depends largely upon himself, and will vary from two to four years. It is not essential that a man serve as an apprentice for each laborer is virtually an apprentice. Where no assistant foreman is authorized, it might be advisable to pay one man in each of three or four gangs on each roadmaster's district, five cents more per hour, in order to attract a good class of men with the understanding that they will be trained for foremen.

Organize a School Gang

By W. F. MUFF
Roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan.

I feel that the day has almost passed when we can depend upon picking our foremen from the ranks of track laborers, because I find that fully 90 per cent of the young Americans who are employed as track laborers do not possess the qualifications to make track foremen, and that in recent years, fully 70 per cent of our present foremen do not qualify as first class foremen, principally due to the manner in which they handle reports, time books, etc. To become a first class track foreman a man should have at least two years' experience under a good foreman, in both section and yard work. He should also be interested in reading publications pertaining to track and track work, as in no other way can he get other men's ideas or learn to study them.

I do not believe that the apprentice system is practical, as my experience has been that not one man in twenty will stay long enough to become interested in his work. My idea is to organize a small floating gang of about 15 men under a first class foreman on each superintendent's division, the railroad to furnish first-class living quarters, properly equipped, which will induce men to stay, even

though at out-of-the-way points. Such a gang should be employed on various roadmasters' territories, working a week or ten days at a time on some particular section or yard, carrying out different kinds of work, such as surfacing, tie renewing, laying rail in small patches, changing frogs and switches, renewing switch ties, ditching, fence building, repairs to railroad and street crossings, in fact, every kind of work that is being done by regular section forces. In this gang each man should act in turn as foreman under the foreman in charge. This gang should work the year around, as a gang of this size can always be employed both winter and summer. The men should be paid a higher rate than the regular trackmen, but the railroad should hold back a certain per cent of their earnings until such a time as they are qualified to be foremen. As soon as a promotion is made another man should be selected for his place in the gang so that the gang is kept to the full 15 men at all times.

One Way to Do It

By Eric Sandberg,
Conrad, Mont.

I was extra gang foreman for many years and when a roadmaster wanted a section foreman I could generally give him a man who had been with me for some years and knew the ropes, and who had been my assistant. But here is another method. My wife raised six sons. I was too busy away from home to do much of the raising till they were big enough to carry water for me in the gang during the summer vacations. Later, I put them to work in the gang. Five of the boys have graduated from both high school and trackwork and two of them have been section foremen on this division.

Some Pertinent Suggestions

By J. P. Costello,
Roadmaster, Atchison, Topeka & Santa Fe, Pueblo, Colo.

Observance of the following recommendations should assist materially in securing, training, developing and retaining in the service a class of foremen valuable to the railroad.

(1) Let the rate of pay to laborers be at least equal to the rate paid to laborers in other industries. This should attract at least a few men in different places who would possess the necessary qualities for development.

(2) Increase the differential between the laborer's pay and that of the foremen.

(3) Grant a greater differential between the ordinary section foreman's pay and that of extra gang or yard foremen.

(4) Let the laborer or young foreman see that he may always have an objective to work to, both in the near and the remote future.

(5) Give the laborers and foremen a show in placing men on special jobs in the maintenance department, for instance, gas welding or motor car maintenance.

(6) Give the trackman a chance in other departments where track experience would be of value as, for instance, the store department.

(7) Do not allow the privileges of seniority to be abused. Let advancement and promotion be the award of ability, merit, and seniority without personal favoritism and remember that in the years to come we will be governed to a great extent by the precedents which we are now establishing and will establish in the next couple of years.

(8) Last and most important of all, strive to arouse and maintain interest in the work. Let the foremen be encouraged to read—to read something that deals with things other than their "rights and wrongs." Most of the literature dealing with trackmen which foremen are most apt to read does not treat of their occupation as a trade or craft, or guild in which they should take pride. It would be a mistake, costly to the railroads, to allow their foremen to lose the traditional pride in their craft.

The Requirements of a Good Foreman

By M. J. Kelleher,
Section Foreman, Great Northern, Columbia Falls, Mont.

One of the first questions asked by any superior officer of a foreman if he is in line for advancement is "How much education have you?" This same question applies also to a man in training for a foremanship. The more righly educated a man is the easier it is for him to be trained. Education should head the list. Discipline, loyalty and respect for the rules are also essential principles that should be taught to the man in training. The nature of track work is such that it cannot be learned in a short time and requires patience.

Personality and the art of leading men go hand in hand. A man lacking the ability to lead his men will not progress very far as a foreman.

On roads where assistant foremen are not employed on section gangs, a trying situation arises in picking a man for training. If the men are all on the same wage and one man is selected, the resentment of the other men will be quickly felt. This could be remedied by a sliding wage scale or the appointment of one of the men as an assistant foreman.

In mountainous countries where floods, heavy snow, huge slides, heaving track and immense engines must be contended with, a foreman oftentimes has to work on his own initiative. Common sense, quick thinking and good judgment will invariably save heavy losses to the company and prevent accidents.

Pick a Foreman who will be Respected

By A. E. Muschott,
Roadmaster, Elgin, Joliet & Eastern, Joliet, Ill.

A track foreman should be at least 21 years of age, a citizen of the United States, be able to speak, read and write the English language and have at least four years experience in track work as a laborer on ordinary sections, on extra gangs doing ballast work, changing out switches, etc.; and one year in yard work. This should enable him to handle a section with a number of switches and railroad crossings.

I do not recommend, as some are advocating, the employment of young men at rates higher than the rest of the men in the gang with a view of training them for foremen because this causes trouble, not only in that gang but sometimes on adjoining sections. A man who has worked in the gang for some time and can do work that the new man cannot do will not take the lead, as he formerly did, under these circumstances. If any such educational system is established, all the men in training should be placed in one gang at some terminal with a differential in the wage.

A section foreman should be a man who is respected in the community in which he lives and by the farmers through whose land his section runs. The section foreman can do much toward developing good feeling between the farmers and the railroad.

The Men Should be Hand Picked

By Willard O. Jones,
Clifton Forge, Va.

There must be a new type of track foreman, improved methods in railroading, improved tools for the use of section gang and a realization on the part of officers that the more section foreman can absorb about railroading in all of its many phases the more efficient his service to the road will be. The graduates of the high schools along the road are the source from which to obtain good men, but many boys of less education will also be found valuable. Invite such young men to attend a meeting where the division engineer can tell them about the opportunities of railroad work. Give each one an applicatiion blank and send him home to discuss it with his parents and advisers. If the blank is returned assign him to a suitable foreman, one who will take an interest in showing and aiding him.

Make these men apprentices rather than laborers. Give them the first two weeks merely to observe. Then, when they are given something to do they will not be likely to fail and lose confidence in themselves. After they become sufficiently proficient in the work, make them assistant foremen. When the foreman becomes satisfied that they are competent he should turn the work over to them. If they are successful give them sections when they are open. This training would, of course, consume a considerable length of time, but the actual length of time depends upon the aptness of the man.

As aids to the actual work, semi-monthly meetings of instruction and discussion should be held. Encourage these men to ask questions which will be answered by the man in charge—preferably the supervisor of the district. In following this plan, it is essential not to lose sight of the ambitious laborer. Give him all that he deserves and if he is capable offer him the advantages of the system of training.

The Requirements Are Severe

By L. Coffell,
Supervisor, Chicago & Eastern Illinois, Momence, Ill.

Of late years section laborers do not measure up to the standard of a generation back. The average good laborer is lacking in energy, ability, integrity and self confidence. He strusts too much to the dictation of others. Therefore, the material for section foremen of today is of an inferior quality. A good section foreman is a mechanic, as well as a clerk. The old timer is growing extinct. Therefore, we must make our foremen from the laborers now in the ranks.

The educational foundation should be of the best obtained in our graded schools. A high school course is not too much these days. Railway managements now expect section foremen to act as agents for them. They must know how to make the material (which represents dollars) last as long as safety permits. They must know how to make up and keep records of all manner of reports. These must be written plainly and intelligently to avoid delays and errors.

A first class foreman obtains his place after at least four years' experience as a laborer, which should consist of two years on a country section in work where he gains knowledge in keeping track up under high speed trains, one year in extra gangs to teach him how to handle large forces and one year in terminal yards which teaches him frog and switch work.

The training of men begins with their selection. Pick a man who can mingle with the gang contentedly and without finding fault, one who has confidence in himself and respects his foreman and fellow laborers. Teach him by friendly firmness rather than force, explain to him thoroughly why a certain piece of work is being performed, as considerable railroad work of today involves a certain amount of temporary work before the permanent work can be done. I have found that a beginner does better work, takes more interest, and learns faster if he knows that he is accomplishing something of benefit.

Some Suggestions from a Foreman

By E. Busenbark,
Section Foreman, Oregon Short Line, Swan Lake, Ida.

When selecting a man for a foremanship, ambition and ability are the main features to be considered as a man requires both to be successful. After working a man in the gang from six months to a year, I can usually tell if he is a prospect for a foremanship. If I decide first he is, I begin by showing him daily the work that is most necessary for the maintenance of good track I have him follow me and watch while I do the work until he begins to grasp the idea. Then I let him go ahead, raising low spots or lining and I follow behind to correct his mistakes. I also show him the necessity of keeping everything in a condition safe for the passage of trains and when slow or stop signals are required.

I caution him to avoid accidents while handling tools and material and to be careful not to waste or destroy material. I tell him what amount of work can be done each day under ordinary circumstances with a regular section gang; what methods of work insure the best progress; how to get results with a small gang; and how to look out for creeping rail, drainage, waterways, etc.

After showing him what there is to do in connection with the clerical duties, I give him copies of the regular forms to be filled out and made up by foremen and have him make them up and hand to me at the end of the month, so that I can show him his mistakes. Undoubtedly a good man can advance while working with different gangs, but I have seen good prospects work under some foremen who never were promoted.

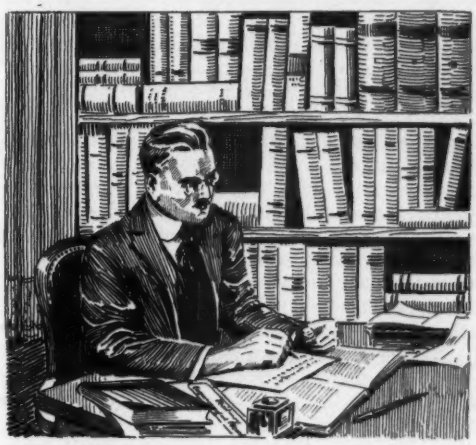
The Training Must Continue After Promotion

By Charles L. Vance,
Section Foreman, Southern Pacific, Merced, Cal.

In my opinion the only way to produce competent section foremen is to induce young men with sufficient education to enter the service as track apprentices under a foreman capable of giving them the proper training and at the same time interest them in the work and discuss the best and most economical methods of handling a section. They should also be induced to take an educational course as I believe this is very beneficial to trackmen, even though they may never have had many years' practical track experience.

The young foremen should not be lost sight of as soon as he is placed in charge of a section. He should be coached for two or three years by the roadmaster, not only by giving him instructions as how work should be handled, but also by encouraging him when he does a good piece work. This will give him more confidence in himself and will inspire him to do his work better. Thus he will become a foreman who can be relied upon to do his work properly without the constant supervison of the roadmaster.

What's the Answer?



This department is an open forum for the discussion of practical problems of maintenance of way and structures. Readers are urged to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also solicits the co-operation of its readers in answering questions.

These Questions Will be Answered in the April Issue

1. Is it advisable to set aside a certain time each week or month for the maintenance of track joints?

2. What is a synchronous motor? What are its advantages and limitations in pumping station service?

3. Should ice houses be ventilated and if so what is the best method of doing it?

4. What precautions should the operator of a motor car take when approaching a highway crossing?

5. To what extent is it practical to size and bore trestle deck timbers before treatment?

6. Is vitrified clay pipe to be recommended for installation under important highways at crossings?

7. How and by whom should storm windows, stoves and other winter equipment be stored?

8. What are the best species of timber for use as crossing planks?

The Objections to Taper Rail

What are the objections to taper rails in place of compromise angle bars for connecting heavy rails with light rails in (1) main lines and (2) side tracks?

First Answer

Compromise angle bars are preferred to taper rails because they are safer, quicker and more economical for laborers to handle. The track walker can make all necessary repairs with compromise joints without delay to traffic. Taper rails require more help in handling and sometimes cause considerable delay to traffic until the necessary repairs can be made. R. Rossi,
General Foreman, Road Department, Illinois Central, Chicago.

Second Answer

We formerly used taper rails 8 ft. 3 in. long to which there was some objection by reason of the shortness of the rail and the resultant increase in the number of joints in a short length of track. We are now using a taper rail 16 ft. 6 in. in length, two being made from a standard 33 ft. rail. The greater length of these rails largely overcomes the objection of shortness. The Southern Pacific generally favors the taper rail over compromise joints.
W. M. Jaekle,
Assistant Engineer of Maintenance, Southern Pacific, San Francisco, Cal.

Third Answer

Both taper rails and compromise angle bars accomplish the object of connecting rails of different weights and sections. The Pennsylvania has preferred using compromise angle bars and has had but little experience with taper rails. One of the main questions to be decided in using taper rails is the shortest length which may be used without detriment in the track. Consideration should also be given to the possibility of making the rail weaker by cutting away the outer and stronger parts in order to provide the reduced section from the heavier one. W. C. Cushing,
Engineer of Standards, Pennsylvania System, Philadelphia, Pa.

Fourth Answer

A taper rail is too short for main line traffic for the reason that it increases the number of bolts to maintain and bring the joints so close together that a train crew is likely to mistake it for a broken rail. No rail in main line should be less than one-half the length of a standard rail, or 16½ ft. If taper rails were made that length, or better still, full standard length, there would not be as much objection to them. I prefer compromise angle bars to 8 ft. taper rails, although I see no particular objection to using taper rails in side tracks. D. O'Hern,
Roadmaster, Elgin, Joliet & Eastern, Joliet, Ill.

Tinting Walls

How should an old hard finished wall be prepared for tinting?

First Answer

In preparing an old hard finished wall for tinting it must first be thoroughly cleaned and dried. It should then be given one, or if necessary, two coats of shellac, taking occasion to go over the shellac with sandpaper to remove any rough particles before applying the tinting color. It is better to use the shellac treatment in preference to the method of preparing a wall by applying a sizing containing glue, for the reason that nothing but alcohol will cut the shellac; whereas, washing the walls with water will often cause the glue to come through.

If the wall is to be white, white shellac should be used in the treatment. If darker colors are to be used, orange shellac can be used. J. V. NEUBERT,
Engineer Maintenance of Way, New York Central, New York.

Second Answer

A further answer to the question is contained in a bulletin recently issued by the Eagle-Picher Lead Company, Chicago, which is abstracted below: In the preparation of an old hard finished wall for tinting any trace of kalsomine should be removed. If the wall is cracked it should be scraped down or sand papered until both sides are flush with the wall. The cracks should be opened slightly by running a knife or trowel through the length sufficiently to permit a filling of plaster paris mixed with water. A small amount of glue sizing should be added to this plaster paris mixture. When the plaster filling is dry, if there are any uneven places in the wall they should be sandpapered slightly. The next operation is to size the entire surface of the wall with alum, zinc or varnish sizing, which, after having dried, will place the wall in readiness for tinting.—[Editor].

Melting Snow With Steam

To what extent is it practicable to use steam for melting snow at yard switches?

First Answer

There is some doubt whether enough steam pipes can be placed between switch ties to provide sufficient heating surface to melt even a light snow falling directly on them. The space over the ties is then left but might be cared for by placing a hood over the steam pipes to deflect the heat along and between the switch ties and rails. If sufficient heating surface can be provided, consideration must be given to the steam rising from the snow coming in contact with the hot pipes. This is very likely to impair vision around a switch and create a hazard. Adequate drainage must be provided to carry off the water formed, for if not, the ice formed around a switch will not only create a dangerous condition but also a condition harder to care for than by moving of snow by hand. F. W. HILLMAN,
Division Engineer, Chicago & North Western, Chicago.

Second Answer

We have not found the use of steam pipes practicable for melting snow at switches, nor do we consider the expense justified. In parts of the country where there is much snow and ice the drainage would be a serious problem, and render the cost almost prohibitive.

We have found it entirely practicable to equip switch engines with pipes leading from the steam dome to the rail so that these engines could be used in melting or blowing the snow away from switches and long leads in yards. This method is used to a considerable extent on the Burlington, which has engines so equipped in practically all yards. By this method switches are kept operating during severe storms and after a storm the work of getting switches in service is greatly expedited. It is necessary, when the weather is extremely cold, to follow up the engine and use salt around the switches to prevent the melted snow from freezing, but this is easily done and quite effective. H. R. CLARK,
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Third Answer

The use of steam for melting snow at yard switches is practicable only at large terminals and passenger stations where there is a power house of ample capacity connected to the plant. Where train movements are frequent and rapid there is an added element of safety in melting snow in this manner.

Steam is very useful in keeping down snow and ice at locations where there are slip switches and power-operated points. It is most useful in regions where there are rapid changes in the weather with alternate thawing and freezing, where ice forms rapidly. With a properly installed steam thawing plant the labor of cleaning switches is reduced and the switches are at all times in good working order.

Each yard and passenger terminal is a problem in itself and the cost of making the steam installation, together with the probable cost of maintenance and operation, must be figured against the known or probable cost of hand labor to arrive at the most economical method of handling the snow. Where steam is used there must be good drainage to carry off the water as soon as it forms, otherwise the results will not be satisfactory.

Unless the main steam pipes are ample and well insulated, the cooling of the steam and the consequent condensation is likely to prove troublesome. The heating pipes around the switches should be at least one inch in diameter to supply enough heating surface. Stone ballast is better than gravel as the heat dissipates itself more readily and the accumulated water is more easily disposed of.

There will, of course, be a limit to which live steam can be carried successfully, even in mains which are insulated. The grade of the yard and its relation to the power house are important factors in deciding whether the steam shall be returned to the power house or wasted through a drip. F. B. TAPLEY,
Engineer Maintenance of Way, Canadian National, Edmonton, Alta.

Air Spaces in Plank Crossings and Platforms

When building plank crossings or platforms is it advisable to leave an air space below the plank?

First Answer

When building plank crossings or platforms it is advisable to leave a space of from 1 to 1½ in. between the planks to allow the ballast underneath to dry. Placing planks close together is unsatisfactory for the reason that it takes so long for the ballast underneath to dry out, as it is almost impossible to place planks close enough to keep out snow and rain. Where there is an opening underneath, the planks should be placed as tightly together as possible. D. O'HERN,
Roadmaster, Elgin, Joliet & Eastern, Joliet, Ill.

Second Answer

My experience convinces me that it is desirable to leave an air space below plank crossings and platforms. It is especially desirable with plank platforms. Plank platforms frequently fail more quickly from decay than from wear and for this reason should be ventilated just as depot floors are ventilated to prevent decay of the joints and floor lining.

An air space is not as essential in crossing construction as in the case of platforms, because the plank crossings usually fail from wear, although where the traffic is heavy the tendency to decay is increased if the planks are put down without an air space below them. This is especially true with certain classes of wood that do not withstand decay well. It is, however, a difficult matter to maintain an adequate air space under highway crossings, even though furring strips are placed on the top of

the ties, and air spaces provided. Dirt from passing vehicles soon works through the cracks between the plank and fills up the air space.

In the case of plank sidewalks across railroad tracks, it is an easy matter to maintain the air space by means of furring strips placed on top of the ties, and this should always be done. F. E. KING,

Division Engineer, Chicago, Milwaukee & St. Paul, Minneapolis, Minn.

Third Answer

An air space should be provided for all structures. Any piece of timber will last longer if it can get a free circulation of air all around it. As an example the writer is reminded of his experience with a piece of board walk that extended partly on comparatively level ground and partly across a depression. On the level ground it was the practice to set the stringers in the ground and spike the plank thereon, leaving very little, if any, air space, with the result that in a comparatively short time it became necessary to renew the planking and on doing so the under side was found badly decayed and the stringers completely rotted away. On the other hand, where the walk crossed the depression many times no renewal of the planking was necessary until the planks were worn so thin as to become unsafe.

Similar observations were made of the floor lining and joists of a warehouse. The floor consisted of a two-inch plank floor lining covered with a one-inch hardwood floor. Instead of using piers and sills to support the joists through the center of the building stone walls had been constructed and neither these nor the outside walls had been provided with the openings to permit the circulation of air. Not long after the building was constructed the floor gave way while trucking a heavy load of freight over it and upon examination it was found that the entire floor lining and all the joists were entirely consumed by dry rot. J. P. WOOD,

Supervisor of Bridges and Buildings, Pere Marquette, Saginaw, Mich.

Fourth Answer

If the wood is treated, ventilation is not important. If platforms must be close to the ground and must be built of untreated wood as much air circulation as possible should be provided but it would be a great deal better to use treated wood. In the case of railroad crossing planks it does not appear practical to allow for ventilation and we believe the very best practice in this case would be to use creosoted wood and lay it in contact with the ties and ballast. GEORGE M. HUNT,

U. S. Forest Products Laboratory, Madison, Wis.

The Minimum Depth for Piles

What is the minimum depth of earth, gravel or sand overlying rock in which it is safe to drive piles for a trestle?

First Answer

The most satisfactory type of trestle where the depth to rock is limited, is with framed bents on concrete footings. The footings should extend from about one foot above ground to the rock and the depth to which it is economical to place them depends on the nature of the overlying material and the amount of water present. Ordinarily this type will be cheaper than piles for depths of eight feet and less.

Whether piles with eight feet of penetration would be safe depends on the nature of the material penetrated and whether drift and scour is to be expected. In sandy material, eight feet of penetration is not enough to hold a trestle in line although it may be enough in heavy compact material. As a general rule I would set the minimum depth for piles at 12 ft. in sand and 10 ft. in more compact material. G. W. REAR,

Engineer of Bridges, Southern Pacific, San Francisco, Cal.

Second Answer

The Rock Island has no definite standard as to the minimum depth of earth, gravel or sand overlying rock in which it is safe to drive piles for a trestle, but the aim is to have at least 12 to 15 ft. It is difficult to hold the bridge in line or to prevent the scouring out of piles with less penetration than this.

I have seen bridges driven with five to eight feet of penetration which had to be taken out and replaced with concrete pedestals in two or three years. This is due to the fact that there was not enough penetration to hold the bridge in line and that with the shallow penetration there was a great deal of churning of the piers.

I. L. SIMMONS,

Bridge Engineer, Chicago, Rock Island & Pacific, Chicago.

The Angle of Culvert Wing Walls

What considerations determine the angle for a wing wall for a culvert placed squarely with the track?

First Answer

In determining the angle for a wing wall at the ends of a culvert crossing the track at right angles, the following points must be considered: (1) the nature of the stream bed above and below the opening and the foundation conditions, (2) the tendency of the stream to scour or change the direction of the channel at each end of the opening, (3) the angle at which the stream approaches and leaves the portals of the culvert, and (4) the variation of high and low water and the character and size of stream. Where one or more of the above do not limit or alter conditions, the wing should be made as short as possible. C. N. BAINBRIDGE,

Engineer of Design, Chicago, Milwaukee & St. Paul, Chicago.

Second Answer

Railroad culvert design, especially those features relating to capacity and angle of wings, seem to be based more or less on empiricism. There are no hard and fast rules as each individual installation carries its own particular problems which must be solved largely through the judgment and experience of the engineer in charge.

The wing walls of a culvert are given a horizontal angle for three reasons: (1) To reduce the entrance velocity of the water, (2) to deflect such water into the culvert, and (3) to protect the bottom of the fill from erosion. While the wing angle is undoubtedly a function of the elements above outlined, it is to a certain extent arbitrary and not reducible to a mathematical basis.

The quantity of water to be cared for will also have some bearing as it determines the capacity of the structure. As this is dependent on such variables as soil conditions, topography, character and contour of watershed area, rate of annual precipitation, subsoil drainage, etc., it is readily seen that a direct relation is difficult to obtain. As a direct answer to the question, I would say that the considerations determining the wing wall angle of a culvert placed squarely with the track or in any other position, depend entirely on the local conditions for each individual structure. H. M. SMITTEN,

Bridge Engineer, Western Pacific, San Francisco, Cal.

Third Answer

The angle of the wing wall depends largely on the size of the culvert and other local conditions such as the character of the water channel. If the channel is deep and well defined the end wall may simply be a short cutoff

wall at right angles with the culvert just sufficient to prevent the earth from rolling down to where it will obstruct the water channel, or it may be at an angle with the axis of the culvert just sufficient to catch the natural slope of 1½ or 1¾ to one, depending on the material.

On the other hand if the water channel is flat and wide, wing walls at an angle of 45 deg. or less with the axis of the culvert are almost always necessary to divert the water to the culvert and prevent excessive wash of the embankment. For small culverts carefully located so as to be even with, or slightly below, the flow line of the natural channel, a wing wall at the lower end is usually unnecessary but a small amount of rock paving may be desirable.

EDWIN M. GRIME,
Supervisor of Bridges and Buildings, Northern Pacific, Fargo, N. D.

Painting the Inside of Steel Water Tanks

How often should the interior of steel water tanks be painted and what is the most suitable paint for this purpose?

First Answer

The U. S. Bureau of Standards has made no investigations on the most durable paints for coating the inside of steel water tanks. It appears to us, however, that a bituminous paint or enamel will be more durable than oil paints for this purpose.

The Navy Department has been using bituminous solutions and bituminous enamels made from coal tar pitch for this purpose. They are purchased on U. S. Navy Specification 52-B-8. Copies of this specification and information as to the success with these materials may be had by addressing the Bureau of Yards and Docks, Navy Department, Washington, D. C.

GEORGE K. BURGESS,
Director, U. S. Bureau of Standards, Washington, D. C.

Second Answer

There is no definite answer for this question within the range of my experience. The interior of water tanks using treated water do not require painting as they will last fully as long with a bare surface as with a coating. It is well to paint the upper portion of the tank which is exposed to the air with any good steel paint.

The problem of finding waterproof coatings which will adhere to steel and stand up under all water conditions is as old as the railroads. The problem is being studied at present by a number of organizations. The ordinary asphalt paints almost always become brittle with age or peel so as to expose the metal surface of the tanks to corrosion.

We have tested out a large number of so-called waterproof paints and have found some that give promise of fair service. However, we are not yet prepared to recommend any single product. It appears to me to be a problem that each railroad will have to work out in accordance with its own peculiar conditions, using that which on test gives promise of the best service. The waters differ so greatly that no rule can be followed fixing a definite interval between frequency of painting.

WILLIAM M. BARR,
Consulting Chemist, Union Pacific, Omaha, Neb.

Third Answer

We have found that the intervals between the painting of the interior of steel water tanks depends a great deal upon the content of foreign matter in the water where the tanks are located. These tanks should be painted at least once in three years, in some cases, once in two years.

When steel tanks first came into use on our line, a carbon vegetable oil paint was used for this purpose, but it was found unsatisfactory and the use of mineral oil paint was begun, which gives better results.

The only disadvantage in the use of mineral oil paint is that it is disagreeable to work with. Men using the paint should be careful not to get it on their hands or face, for the reason that it burns and on some men causes further trouble.

In painting the tanks, they are taken out of service, drained and left open for the circulation of air through the drum of the tank. In good weather these tanks dry out pretty well in one day. At the same time, the mud is cleaned from the bottom and sides. They are painted the second day after draining, and after the third day, in the case of mineral oil paint, they are ready for service.

F. A. BENZ,
Division Engineer, Buffalo, Rochester & Pittsburgh, East Salamanca, N. Y.

Cleaning Ballast at Railway Crossings

What is the practical way of cleaning rock ballast at railway crossings subject to heavy traffic?

First Answer

There is no satisfactory method of cleaning ballast at railway crossings except to dig out the ballast, screen it and replace it with clean ballast. Cleaning ballast at railway crossings is largely a question of drainage and adequate drainage should be provided in order to reduce the necessity of cleaning ballast to a minimum. This can be provided at certain points by installing French drains, but if conditions will not permit their use adequate sewers should be provided.

J. B. MARTIN,
General Inspector of Track, New York Central, Cleveland, Ohio,

Second Answer

Any practical way of cleaning rock ballast at steam railway crossings must, of necessity, be one that can be carried out by the regular forces. Under these circumstances, a satisfactory and practical method consists of forking out the ballast to a depth of 3 in. below the bottom of the ties in the track and 12 in. below the bottom of the ties between tracks. Where tile drains are not already provided such drains should be installed, a line of tile being placed between the tracks and extended beyond the intersecting track or tracks. The ends of this line of tile should connect with cross drains to prevent any water from working its way down to the crossing itself. The old ballast should then be well cleaned by forking and the clean stone returned to the track, following which the crossing should be thoroughly tamped, preferably accompanied by a one-inch lift. All bolts should be tightened, spikes re-driven and tie plates renewed where much wear is evident.

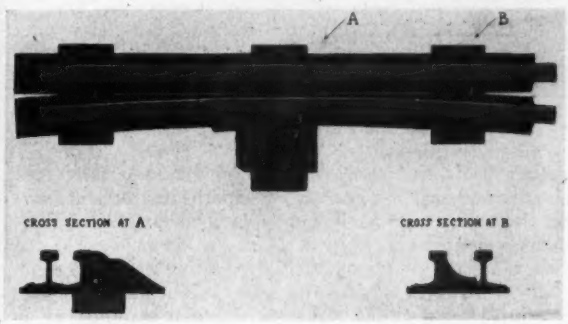
A. M. KING,
Division Engineer, Lehigh Valley, Jersey City, N. J.

Concrete Bunk Houses Fit Into the Landscape in California

New and Improved Devices

A New Guard Rail Appliance

CLAMPS of unique and distinctive design for securing turnout guard rails have recently been put on the market after three years of intensive service on two southern railroads. One noteworthy feature of these guard rails is the simplicity of the design. There are only five parts, all of malleable iron, two of which are



Details of the Guard Rail

duplicates. These are assembled in three units, each serving both as guard rail fastenings and as tie plates supporting the running rail and guard rail on three of the ties under the guard rails and frog.

The end units consist of a plate and spacer cast in one piece. The center unit consists of a reinforced plate

The Guard Rail in a Busy Turnout

having a shoulder on the outside to grip the flange of the running rail and a rail brace on the inside to back up the guard rail, this plate being used in conjunction with a block that fits against the back of the guard rail with the aid of a long taper wedge. Thus the shoulder on one end of this plate and the rail brace on the other end, together with the wedge adjustment, insure a positive connection of the running and guard rails entirely independent of the spiking of the plate to the tie. The adjustment of the wedge provides for ample takeup for wear which is obtained quickly by striking the end of the wedge, which is prevented from backing out by a split cotter driven into any one of a row of holes in the edge of the wedge.

The first installations of this guard were made in August, 1920, on the Atlantic Coast Line at Orlando, Fla., and Winter Park. Shortly after this installations were made at six other points on this line and later on a number of heavy service turnouts in yards on the Southern. These installations are reported to be giving satisfactory results, special attention being called to the fact that they have eliminated derailments at points where they had frequently occurred previous to placing them in service. This guard rail is the invention of W. L. Daughtry, section foreman on the Atlantic Coast Line and is known as the Daughtry guard rail. Sales are being handled by the Safety Appliance Sales Company, Chattanooga, Tenn.

A Woodworking Machine Designed for Many Uses

A NEW combination woodworking machine has been placed on the market by the C. H. & E. Manufacturing Company, Milwaukee, Wis., which has practical application to carpenter shops where it is desired to perform as many operations as possible with the minimum number of machiners. It combines in one machine a rip and cross-cut saw, a right handed operated 12-in. jointer, a hollow-chisel mortising and boring attachment, a 27-in. band-saw, a sander, an emery wheel and a dado head. Each attachment has as much capacity and will do as accurate work as an independent mill. The use of any one of the attachments does not interfere with the operation of any of the others. Each one has its own clearance and does not have to be removed in order to operate another. Each attachment is individually controlled by a clutch, with levers mounted on the front of the machine.

The table is 42 in. by 50 in. and is mounted on a riveted steel frame, the table being a steel plate which has its edges turned down for greater stiffness. The rip saw is mounted so that it can be raised or lowered, consequently the same saw can be used to take care of any ripping thickness. The saw belt is provided with an automatic belt tightener, which keeps a constant tension on the belt.

The jointer is built along the lines of the standard shop machine, with the main frame shaped to fasten rigidly to the side of the saw frame. It is adjustable to any angle up to 45 deg. and can be locked in position. It is stopped and started by means of a friction clutch

on the countershaft. The head carries four knives 12 in. long.

The boring and hollow-chisel mortising attachment is fastened to the saw frame. It has a horizontal travel of eight inches, is controlled by a foot pedal, and is automatically returned by a spring. This attachment will cut mortises up to ¾ in. to any length, and will bore holes up to 1½ in. in diameter. The band saw attachment is driven by a separate belt and is controlled by a belt shifter. It has a horizontal capacity of 27 in. and a vertical capacity of 12 in. The iron table can be tilted to any angle up to 45 deg. and locked in position. Special adjustable dado heads, cutter heads and moulding knives can also be furnished.

The machine is operated by a four-cylinder gasoline engine mounted inside of the frame. It is a four-cycle, water-cooled engine with cylinders of 3⅛ in. bore and 4½ in. stroke and will develop 22 hp. at a speed of 1,500 r. p. m.

A machine of this type has been in use for the past nine months in the carpenter shop of the Pennsylvania at Williamsport, Pa., where it has been employed on a wide variety of woodworking operations in connection with the making of desks, doors, window frames, etc. Since this machine has been in use the time and labor of 3 carpenters have been saved, while the machine has performed work that formerly required at least 12 men. One feature of importance in connection with the use of this machine to which attention is called is that it is not necessary to provide at once all of the attachments which may be used with the machine, for, as necessity develops, they can be added.

Four Men Can Work at the Machine Without Interfering with Each Other

Light Weight Concrete Slabs for Building Construction

THE increasing use of concrete in building construction has resulted in many methods of manufacture and utilization of this material which are distinct departures from the commonplace. One of the latest is the manufacture of light weight reinforced concrete slabs for building purposes, which contain so many air cells that their weight is about one-third that of a solid slab of the same dimensions.

These Porete slabs, as they are called, are pre-cast in steel forms by an interesting method. The mixture consists, essentially, of three parts of cement, one part of sand and seven parts of 1/16-in. to ⅛-in. round pellets of a material which is solid at ordinary temperatures but which melts easily in hot water. This mixture, carefully made, is then poured and allowed to set. The reinforcing consists of expanded metal, placed about ¼ in. from the lower surface. The slabs, after settling sufficiently to permit the removal of the forms, are placed in ovens to which steam is admitted, melting the pellet material which runs out of the slabs and is collected in a sump for further use. Complete removal of the material is obtained by a final application of superheated steam, leaving slabs of a uniformly honey-combed structure. The finished size of the slabs is 24 in. by 32 in. by 1⅛ in., with a weight of about 30 lb., including reinforcement, or about 6 lb. per sq. ft. of surface. They are designed as reinforced concrete slabs and to take loadings of 40 lb. per sq. ft., with a factor of safety of over six. For floor construction, or for extra heavy roof construction, additional cement is applied to the surface of the slabs after laying, the application of an additional ½ in. increasing the permissible loading to 125 lb. per sq. ft., with a factor of safety of five, beams beings set on 32 in. centers. These slabs are fastened on steel structures by means of steel clips but in the case of timber beams or studding, they are simply nailed with ordinary wire nails.

How the Porete Slabs Are Laid

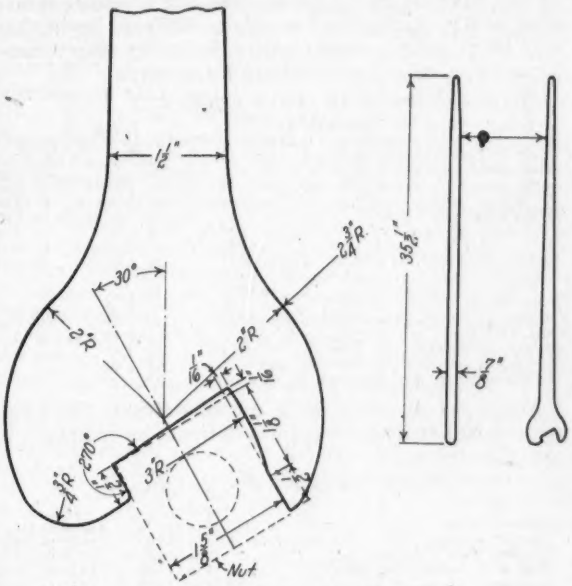
Applying Cement Grout to a Flat Roof of Porete Slabs

As a general rule, when Porete slabs are used for roofing they are given a light coating of cement grout and then waterproofed with any good waterproofing compound. They can also be used as a base for shingle, prepared or other classes of roofing. When used as walls or siding, the slabs are generally covered with some form

of cement plaster, and when used for flooring they are given a one-half inch to one-inch wearing coat of cement mortar. These light weight slabs are manufactured by the Porete Manufacturing Company, Newark, N. J.

An Ingenious Wrench

A PECULIAR design of wrench of the one-piece, fixed-jaw type has recently been developed which possesses a number of advantages, the most important being that it performs the same operation as a ratchet wrench without having any movable parts. For this reason it is peculiarly adapted for use as a track wrench. A few minutes' study of the drawing will demonstrate that, owing to the arrangement of the jaws, a movement of the wrench handle in one direction will firmly engage the nut and turn it while a movement in the



Details of the Bettison Wrench

opposite direction will at once release the nut, which remains stationary as the jaws slide freely over it until they are in position to engage the succeeding pair of nut faces.

As shown in the drawing the faces of the jaws are inclined 30 deg. from the normal position of wrench jaws and that while one jaw has a length equal to the side of the nut the other jaw is relatively short. The long jaw has a bearing face for only a short distance at its outer end, the remaining portion of its length being hollowed out to give adequate clearance for the inner corner of the nut when the wrench is being turned back to take a fresh grip.

In addition to its utility in performing the service of a ratchet wrench, this device is particularly adapted to the accommodation of undersize and oversize nuts. Moreover, the angle of the handle is such that pressure applied in tightening a nut grips the nut more firmly instead of giving it a tendency to slip off. In fact, the direction of the pull on the wrench in tightening a nut differs by 120 deg. from the direction in which the wrench must be moved in order to release it from the nut.

This device is known as the Bettison wrench and is manufactured by the Verona Tool Works, Pittsburgh, Pa. It may be had either in the form illustrated or as a double ended wrench designed for two different sizes of nuts. It is now in use on the Chicago, Burlington & Quincy and the Union Pacific, and is being tested on a number of other roads.

A Device for Sawing Rail in Track

THE Chicago, Burlington & Quincy is now experimenting with a portable rail cutting machine which is essentially a modified form of crosscut saw operated by an electric motor so fixed on a cast iron base as to be readily and rigidly fastened to any type of rail. The machine is adapted for operation in connection with the numerous generating plants which are now on the market similar to those used for operating electric tie tamper equipment.

The illustration shows the general appearance of the machine, and the method of clamping it to the rail. After the machine has once been clamped it is not necessary to lift it off after every cut as the clamping arrangement permits the shifting of the machine in the clamped position along the rail. While the machine is heavy, the rear end may be lifted by one man and shifted into a new

A Set-Up of the Racine Rail Cutter, Showing the Method of Clamping

position. The machine has worm gears with suitable ball bearings to take up the thrust, features which have substantially improved the service obtainable. The cutting operation is automatic and when started no further attention is necessary until the cut is finished. This cutting is sufficiently rapid to sever a 100-lb. rail in from 15 to 20 min., producing a cut that is clean and accurate.

The machine is known as the Racine high-speed portable rail cutter and is a product of the Racine Tool & Machine Company, Racine Wis.

Unique Bridge on the "Metro" in Paris, Riveted Trusses Are Continuous and Curved to 400-ft. Radius

With the Associations

Metropolitan Track Supervisors' Club of New York

The last meeting of the Metropolitan Club, which was held at the Martinique Hotel, on January 12, brought out an attendance of 86. Much of the work of this organization is conducted through committees and the principal business of this meeting was the presentation and discussion of a committee report on the construction and maintenance of highway crossings. An abstract of this report appears elsewhere in this issue. The club has admitted 29 new members thus far during the winter season.

Maintenance of Way Club of Chicago

The Maintenance of Highway Crossings was also the subject for discussion at the meeting of the Maintenance of Way Club of Chicago at the Auditorium Hotel, on January 23, with an attendance of 60. The subject was presented in the form of a paper by J. S. Hyatt, engineer maintenance of way of the Chicago, North Shore & Milwaukee, an abstract of which is presented elsewhere in this issue.

The next meeting of the club will be held on February 13, when a paper will be presented by B. M. Cheney, general inspector of permanent way and structure, Chicago, Burlington & Quincy, on "How to Secure the Maximum Service from Rails."

Directory of Associations

American Railway Bridge and Building Association.—C. A. Lichty, secretary, C. & N. W. Ry., 319 North Waller Ave., Chicago. Next convention Kansas City, Mo. October 14-16, 1924. Exhibit by Bridge and Building Supply Men's Association.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn St., Chicago. Annual convention, Congress Hotel, Chicago, March 11-13, 1924. Exhibit by National Railway Appliances Association.

Bridge and Building Supply Men's Association.—John Nelson, secretary, Joseph E. Nelson & Sons, 3240 South Michigan Ave., Chicago. Exhibit in connection with annual convention of American Railway Bridge and Building Association.

National Railway Appliances Association.—C. W. Kelly, secretary, People's Gas Bldg., Chicago. Annual exhibit at Coliseum, Chicago, in connection with convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—P. J. McAndrews, secretary, C. & N. W. Ry., Sterling, Ill. Next convention, Commodore Hotel, New York, September 16-18, 1924. Exhibit by Track Supply Association.

Track Supply Association.—W. C. Kidd, secretary, Ramapo-Ajax Corporation, Hillburn, N. Y. Exhibit in connection with convention of Roadmasters' and Maintenance of Way Association.

The Material Market

THE situation presented by the market for all basic construction materials is entirely different from that which prevailed a year ago. Today the prices are appreciably higher than at that time but there is a further difference in that, whereas, the beginning of 1923 was characterized by a general advance in prices, the present time finds the market practically stationary. As a consequence, buyers are generally more conservative in their purchases, limiting them to the requirements of the immediate future. However, in spite of this tendency the general demand is in sufficient volume to call for large scale production. The structural steel market is particularly active. Thus, the orders for structural steel during December totaled 181,741 tons, or approximately 81 per cent of capacity, and is the largest total since April, 1923. Orders reported during January indicate a volume measuring well up to that for December. Railroad buying has also been active, recent orders including reservations for rail as well as both cars and locomotives.

PRICES IN CENTS PER POUND

	December 20		January 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$3.00 to $3.15	.... to $3.10	$3.05 to $3.15	..... to $3.10
Track bolts	4.00 to 4.25	.... to 4.10	4.00 to 4.25	.... to 4.20
Angle bars	.... to 2.75	.... to 2.75	.... to 2.75	.... to 2.75
Tie plates, steel	2.55 to 2.60	.... to 2.60	2.55 to 2.60	.... to 2.60
Boat spikes	.... to	.... to	3.25 to 3.50	3.59 to 3.84
Plain wire	.... to 2.75	.... to 3.19	.... to 2.75	.... to 3.19
Wire nails	.... to 3.00	.... to 3.34	.... to 3.00	.... to 3.34
Barbed wire, galv.	.... to 3.80	.... to 4.14	.... to 3.80	.... to 4.14
C. I. pipe, 6 in to 12 in., per ton	.... to	.... to 55.20	.... to	.... to 56.20
Plates	.... to 2.50	.... to 2.60	.... to 2.50	.... to 2 60
Shapes	.... to 2.50	.... to 2.60	.... to 2.50	.... to 2.60
Bars, soft steel	.... to 2.40	.... to 2.50	.... to 2.40	.... to 2.50
Rivets, structural	.... to 2.90	.... to 3.24	.... to 2.90	.... to 3.24
Reinforcing bars	.... to 2.40	.... to	.... to 2.40	.... to ....
Open hearth rail, per gross ton, f. o. b. mill				$43.00

While not as active as a month previous the scrap market still indicates an upward trend, as indicated in the table below:

PRICES PER GROSS TON AT CHICAGO

	December	January
Relaying rails	$32.00 to $35.00	$32.00 to $35.00
Rails for rerolling	18.00 to 18.50	19.50 to 20.00
Rails less than 3 ft. long	19.50 to 20.00	20.50 to 21.00
Frogs and switches cut apart	17.25 to 17.50	18.50 to 19.00
Steel angle bars	19.00 to 19.50	19.50 to 20.00

The table of lumber prices given below indicates a general advance for Southern pine prices with the Douglas fir quotations practically stationary. The lumber market indicates renewed activity. Although the orders on hand with the Southern pine mills fall approximately 100,000,000 ft. b. m. short of the totals at the corresponding time in 1923, the market shows a decided improvement over the conditions prevailing throughout the month of December.

SOUTHERN PINE MILL PRICES

	December	January
Flooring, 1x4, B and B flat	$43.30	$44.55
Boards, 1x8, No. 1	37.40	39.15
Dimension, 2x4, 16, No. 1, common	25.85	26.60
Dimension, 2x10, 16, No. 1, common	25.85	28.55
Timbers, 4x4 to 8x8, No. 1	27.60	29.40
Timbers, 3x12 to 12x12, rough	38.60	38.70

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$30.00
Boards, 1x8, 6 to 20, No. 1, common	19.50
Dimension, 2x4, 16, No. 1, common	18.50
Dimension, 2x10, 16, No. 1, common	18.50
Timbers, 6x6 to 8x8, No. 1, common	26.00
Timbers, 10x10 to 12x12, rough	25.00

	$31.00		
	19.50		
	18.50		
	18.50		
	25.00		
	25.00		

No changes have been noted in the market for Portland cement except some minor adjustments. The quotations given below give the price of cement per barrel in carload lots, not including package:

Chicago	$2.40	Albany	$2.32
Cincinnati	2.44	Buffalo	2.48
Davenport	2.33	New York	2.25
Minneapolis	2.42	Philadelphia	2.41
Pittsburgh	2.19	Richmond, Va.	2.47
Boston	2.63		

News of the Month

The Southern Pacific has put into effect what is claimed to be the longest regular locomotive run in the world, a distance of 815 miles between El Paso, Tex., and Los Angeles, Cal.

The National Railways of Mexico have temporarily discontinued construction work on the new line from Mexicali, Lower California, to the Gulf of California, pending the outcome of the present revolutionary movement.

Plans are being made for the electrification of the Baltimore & Ohio lines on Staten Island, in New York harbor. It is expected that the first section to be undertaken will be the line of the Staten Island Rapid Transit railway from St. George to Tottenville and South Beach. This includes about 16 miles of lines carrying suburban passenger traffic and will involve an expenditure of approximately $6,000,000.

On January 8 the United Supreme Court sustained the constitutionality of the recapture provisions of the Transportation Act, which require the railroads to refund to the government one-half of any return in excess of that established by the Interstate Commerce Commission as "fair." Nineteen roads joined in attacking the validity of the recapture provisions in order to determine its constitutionality.

A series of declarations emphasizing the need for the adequate development and co-ordination of the national transportation systems and urging that no change be made in any important provision of the Transportation Act at present, was adopted by the National Transportation Conference of the United Chamber of Commerce at the close of a two-day session in Washington on January 10. The conference was attended by approximately 100 representatives of transportation, industrial, labor and agricultural interests from all parts of the country.

Forty-five railroads, not included heretofore in the order of the Interstate Commerce Commission with reference to automatic train control installations, have now been ordered to install such devices on a full passenger locomotive division by February 1, 1926. This makes a total of 94 class 1 railroads which have been ordered to install train control equipment. In addition to the order issued upon the 45 additional railroads, the Interstate Commerce Commission has also ordered 47 of the 49 roads named in its original order to make an installation on an additional division.

The year 1923 was characterized by unusual uniformity of traffic. The peak figure of weekly car loading, 1,097,274 for the last week of September, was only 33 per cent above that for the lowest week in the year. During 1923 the weekly car loadings exceeded 1,000,000 cars in 21 different instances while previously these weekly loadings had exceeded 1,000,000 only seven times. The average daily movement of freight cars reached 30.7 miles in October, 1923, a figure which had never before been reached in any month and which was in excess of the goal of 30 miles set by the railroads.

The cost to the government of federal control and the six months' guarantee period of railroads following the end of the period of federal control is now reported to be $1,696,000,000, including $563,000,000 for the guarantee period, according to a report submitted to President Coolidge on January 3, by the director-general of railroads. The same report states that of claims from roads with railroad claims against the government, 99 per cent of the mileage taken over by the government were settled by the Railroad Administration by the end of 1923.

The total number of railway employees in 1923 averaged approximately 1,880,000, which was greater by 235,000 than the average in 1922. It was, however, less by 174,000 than in 1920, in spite of the fact that the freight traffic handled in 1923 was greater than in 1920, as was also the physical amount of maintenance done to equipment and roadway. The railway employees received a greater annual compensation in 1923 than in 1922 by about 1.4 per cent, the average compensation being estimated at $1,645 as compared with $1,622 for 1922. The total payroll of class 1 railways was $3,100,000,000 in 1923, as compared with $2,669,000,000 in 1922, or an increase of $431,000,000 or 15.1 per cent.

The Pere Marquette, following its annual track inspection, awarded a prize of $100 to William O'Brien, track supervisor on the Toledo division, with headquarters at Toledo, whose subdivision received the highest rating, 90.41. Henry McLaughlin, track supervisor on the Canadian division, with headquarters at St. Thomas, Ont., was also given a prize of $100 for the supervisor's district which showed the greatest improvement as compared with the previous year. In addition to these awards, prizes of $25 each were given to 14 section foremen whose sections showed the highest average on each supervisor's subdivision and to 13 section foremen whose sections manifested the greatest improvement for the year.

The Kansas City Southern has installed a boiler washout system and other improvements at its locomotive terminal at Pittsburg, Kan., under a plan which provides for their payment on a rental basis out of the operating economies expected from their use. This is a method similar to that under which much of the rolling stock of the railroads is being bought and promises to come into extensive use as a means of financing railway improvements which cannot be financed under the ordinary methods. In its application to the requirements of railroads, the trust plan, as it is called, takes the form of an agreement providing for the construction and installation of certain specified facilities and their rental to the railroads for a period of from two to ten years at a stipulated monthly rental. The railroad agrees to use and maintain the equipment in good order and that if any of the notes should not be paid the right of the railroad to use the equipment shall be suspended.

Stresses in track; stresses in structural steel; fire prevention at docks, piers and wharfs and concrete and reinforced concrete arches were prominent among the subjects presented in final or progress reports at the annual meeting of the American Society of Civil Engineers at New York on January 16 to 18. The report on stresses in railroad track contained the results of some 400,000 observations on tangent and curved tracks on the electrified section of the Chicago, Milwaukee & St. Paul, and on the Richmond, Fredericksburg & Potomac, the Baltimore & Ohio and the Lehigh Valley. The work on the St. Paul included measurements of the lateral movement and tilting of the rails under different types of power and loadings, while the tests in the east were undertaken largely to determine the stresses in rail and their effect on maintenance for vertical and canted rail. A. S. Bowen, assistant chief engineer of the Great Northern, with headquarters at Seattle, was elected a vice-president and Robert Farnham, engineer of bridges and buildings of the Pennsylvania at Philadelphia, and Arthur O. Ridgway, chief engineer of the Denver & Rio Grande Western at Denver, were elected directors, among others.

Personal Mention

General

L. A. Downs, operating vice-president of the Central of Georgia, and an engineer by education and experience, was elected president on January 8, following the death of W. A. Winburn. Mr. Downs was born at Greencastle, Ind., on May 9, 1872, and was graduated in 1894 from Purdue University. He entered railway service on February 12, 1895, as an employee in the engineering department of the Vandalia. He subsequently entered the engineering department of the Illinois Central and was engaged in various minor engineering capacities until 1898, when he was promoted to roadmaster. He served as a roadmaster for eight years, when he was promoted to assistant chief engineer maintenance of way. He was promoted to division superintendent on December 6, 1910, and served in this capacity on various divisions until January 15, 1915, when he became general superintendent of the Illinois Central, Southern lines. A year and a half later he was transferred to the Northern lines in the same capacity and on January 1, 1915, was promoted to assistant general manager. He was elected vice-president and general manager of the Central of Georgia, a subsidiary of the Illinois Central, on March 1, 1920. Mr. Downs was president of the American Railway Engineering Association in 1921-1922.

L. A. Downs

Engineering

H. O. Wagner, acting division engineer on the Plains division of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been promoted to division engineer with the same headquarters.

G. H. Hicks, valuation and property engineer of the Northwestern Pacific, has been promoted to chief engineer in charge of construction, maintenance and valuation, with headquarters at San Francisco, Cal.

Lee H. Landis, general manager of the Alaska Railroad, with headquarters at Anchorage, Alaska, has assumed the duties of **F. A. Hanson,** engineer of maintenance and construction, who has been granted leave of absence.

K. H. Hanger, assistant engineer maintenance of way, Missouri-Kansas-Texas, with headquarters at Dallas, Tex., has been promoted to engineer maintenance of way, with the same headquarters, succeeding **H. H. Johntz,** whose death was reported in the January issue.

Daniel Hubbard, assistant engineer on the staff of the superintendent maintenance of way of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., has been promoted to division engineer of the Chicago division, with headquarters at Peru, Ind., succeeding **H. A. Bertram,** assigned to other duties. Mr. Hubbard is succeeded by **C. H. Zentmyer.**

S. L. Church, engineer maintenance of way of the Pennsylvania, Northwestern region, with headquarters at Chicago, has been transferred to Cleveland, Ohio, pursuant to a reorganization in the Northwestern region, succeeding **F. H. Watts,** who has been transferred to the office of the chief engineer maintenance of way of the Central region, with headquarters at Pittsburgh.

T. L. Boyle, division engineer of the Grand Rapids division of the Pennsylvania, with headquarters at Fort Wayne, Ind., has been appointed division engineer of the new Grand Rapids division, which includes the old Mackinaw division. **C. D. Bunting,** division engineer of the Mackinaw division, has been appointed assistant division engineer of the Grand Rapids division, with headquarters at Grand Rapids, Mich.

T. P. Polson, supervisor of track on the New York, New Haven & Hartford, with headquarters at Framingham, Mass., has been promoted to assistant division engineer with headquarters at Danbury, Conn., succeeding **A. L. Bartlett,** who has been promoted to division engineer at Boston, Mass. Mr. Bartlett succeeds **John S. Ruff,** transferred to Providence, R. I., succeeding **H. F. Fifield,** transferred to New Haven, Conn., vice **E. E. Oviatt,** promoted to maintenance engineer of the lines west and the Central New England, with headquarters at New Haven, Conn., succeeding **R. L. Pearson,** promoted to engineer maintenance of way, as noted in the January issue.

L. I. Hammond, whose promotion to division engineer on the Los Angeles & Salt Lake, with headquarters at Salt Lake City, Utah, was noted in the January issue, was born on September 8, 1887, at Millville, Utah, and was graduated from the University of Utah in 1910. He was employed as an assistant engineer on the Oregon Short Line from 1915 to May, 1918, when he entered military service as first lieutenant, Engineers. He resumed his duties as assistant engineer in September, 1919, and continued in the same capacity until his recent promotion to division engineer on the Los Angeles & Salt Lake.

E. R. Lewis, whose promotion to principal assistant engineer of the Michigan Central, with headquarters at Detroit, Mich., was noted in the January issue, was born on November 20, 1869, at Raritan, N. J., and graduated from the University of Iowa in 1890. He entered railway service in 1885 as an axman and rodman on construction on the Missouri Pacific, subsequently serving as levelman and clerk in the timber department. He was promoted to division engineer in 1891 and left railroad service the following year to become a reclamation engineer in Wyoming. He was appointed division engineer on improvement work on the U. S. government levees along the Mississippi river in 1896, and in 1897 was locating engineer for the Cape Government railways in the Cape Colony, South Africa. He returned to the United States in 1901 and was consecutively engineer in charge of construction of the White River railroad at Batesville, Ark., and engineer in charge of location and construction of the Fort Smith & Western until 1903, when he returned to the Cape Government railways, where he was consecutively employed as location engineer and district engineer in charge of maintenance until 1905 when he again returned to the United States. He was appointed assistant engineer of the Keweenaw Central, now a part of the Copper Range, with headquarters at Hancock, Mich., in 1905, and in August, 1906, he was appointed division engineer on the Michigan Central, with headquarters at Bay City, Mich. In June, 1912, he was appointed assistant to the general manager of the Duluth, South Shore & Atlantic, and in July, 1918, was promoted to chief engineer. He became editor of the Maintenance of Way Cyclopedia in March, 1919, and upon the completion of this work was appointed office engineer of the Michigan Central in March, 1921, continuing in this position until his recent promotion to principal assistant engineer.

E. R. Lewis

Track

T. D. Morrison, assistant engineer on the Baltimore & Ohio, with headquarters at Akron, Ohio, has been appointed supervisor of track, at Massillon, to succeed **E. Landis.**

A. M. Davidson has been appointed to the joint position of assistant trainmaster and supervisor of track on the Martin district of the Big Sandy division of the Chesapeake & Ohio, with headquarters at Martin, Ky.

James F. Sherron, Jr., assistant supervisor of track on the Philadelphia & Reading, with headquarters at Reading, Pa., has been transferred to Philadelphia, Pa., to succeed **Joseph T. Sturman,** promoted to supervisor, as noted in last month's issue.

E. M. French, assistant on the engineering corps of the Pennsylvania, with headquarters at New Castle, Pa., has been promoted to assistant supervisor of track on the Conemaugh division, with headquarters at Freeport, Pa., to succeed **W. R. Pardin,** who has been transferred to the Pittsburgh division, with headquarters at Derry, Pa., in place of **C. D. Bush,** who has been promoted to supervisor on the Pittsburgh division, with headquarters at South Fork, Pa.

John A. Skehan, whose promotion to supervisor on the Mississippi Central, with headquarters at Hattiesburg, Miss., was noted in the January issue, was born on November 29, 1879, at Paulden, Miss., and entered railway service in 1901 as an employee on the Gulf & Ship Island. From 1901 to 1903 he was an employee on the Louisiana & Arkansas and subsequently to May, 1903, has been in the service of the Mississippi Central as section foreman until his recent promotion to supervisor.

Albert A. Cross, cost engineer on the New York, New Haven & Hartford, has been promoted to assistant supervisor of track on the Central New England division, succeeding **N. A. Schutz,** promoted to supervisor of track, with headquarters at Framingham, Mass., to succeed **T. P. Polson,** promoted to assistant division engineer, as noted elsewhere in these columns. **W. H. Haggerty,** work train foreman on the New York division, has been promoted to supervisor of track with headquarters at Hartford, Conn., to succeed **J. P. Barnes,** deceased.

Joseph T. Sturman, whose promotion to supervisor on the Philadelphia & Reading, with headquarters at Philadelphia, Pa., was noted in the January issue, was born on March 30, 1894, at Pottsville, Pa., and entered railway service on July 1, 1910, as a clerk in the supervisor's office of the Philadelphia & Reading at Pottsville. He was transferred to the chief engineer's office as rodman on March 23, 1914, and served successively as rodman, levelman and transitman until May 13, 1918, when he was promoted to assistant supervisor on the New York division at Philadelphia. He was appointed acting supervisor at Philadelphia on January 1, 1923, and was serving in this capacity at the time of his promotion to supervisor.

Milton H. Dodd, whose promotion to roadmaster on the Michigan Central, with headquarters at Vassar, Mich, was noted in the issue of December, 1923, was born on August 3, 1879, at Tilbury, Ont., and entered railway service with the Michigan Central as a section laborer in 1898, being promoted to section foreman in 1901. He became general foreman for the Detroit River Tunnel Company on October 28, 1907, but returned to the service of the Michigan Central in 1909 as section foreman at Windsor. He was transferred to Detroit on May 3, 1912, as an extra gang foreman, and held this position until June 1, 1916, when he was promoted to assistant roadmaster at Detroit. He was transferred in the same capacity to Bay City on September 1, 1916, and was holding this position at the time of his recent promotion to roadmaster, with headquarters at Vassar, Mich.

Bridge and Building

George E. Tebbetts, formerly bridge engineer of the Kansas City Terminal and more recently connected with the Detroit Graphite Company, has been appointed general supervisor of bridges and buildings, a newly created position with system jurisdiction, on the Chesapeake & Ohio, with headquarters at Richmond, Va. Mr. Tebbetts was born at Chicago, Ill., on March 6, 1877, and was graduated from the University of Illinois with a B. S. degree in civil engineering in 1899. He entered railway service on the Chicago Junction Railway in June of the same year. In November, 1900, he left railway service to enter the employ of the United Gas Improvement Company as an inspector, where he remained until November, 1901, when he accepted a position as draughtsman in the New Jersey Zinc Company. In June, 1903, he re-entered railway service as a draughtsman in the bridge department of the Chicago, Milwaukee & St. Paul, leaving this road in September, 1904, to enter the employ of the Chicago, Burlington & Quincy as draughtsman and subsequently as office engineer until July, 1910, when he was appointed bridge engineer for the Kansas City Terminal, with headquarters at Kansas City, Mo. In February, 1918, he was granted a leave of absence to assume a civilian position as assistant to the manager of the Wood Ship division with the Emergency Fleet Corporation at Washington, D. C., where he remained until February, 1919, when he was appointed general manager of the York River Ship Building Company. In November, 1921, he entered the employ of the Detroit Graphite Company, remaining with this company until his recent appointment as general supervisor of bridges and buildings, as noted above.

Purchases and Stores

A. C. Douglas, assistant general purchasing agent of the Canadian Pacific, with headquarters at Montreal, Que., has been appointed purchasing agent, with headquarters at Vancouver, B. C., to succeed **B. W. Roberts,** who has been promoted to assistant general purchasing agent, with headquarters at Montreal.

The Pennsylvania's purchasing department is now in process of reorganization and consolidation. The practice heretofore in effect of buying supplies for each of the four regions separately will be discontinued. In its place a plan will be adopted by which all materials and supplies will be classified into groups, or sections, with a designated officer of the purchasing department in charge of the buying of each group. The work of all groups will be carried on directly under the supervision of **Samuel Porcher,** general purchasing agent of the system, whose headquarters will continue to be in Philadelphia. Assistant purchasing agents will also be stationed at Pittsburgh, Chicago and St. Louis, reporting to the general purchasing agent. They will cooperate with the vice-presidents and other authorities of the Central, Northwestern and Southwestern Regions, respectively. As the headquarters of the Eastern Region are in Philadelphia, it is not considered necessary to make a similar arrangement for the Eastern Region. Simultaneously with the changes in the purchasing department, a somewhat similar organization will be made of the stores department. **C. D. Young,** general supervisor of stores, will continue as head of the department, with the new title of stores manager, and will have his offices in Philadelphia, as heretofore. The handling of stores will be directed from Philadelphia and Altoona, Pa., at each of which points a general storekeeper will be appointed, with assistants.

Obituary

J. W. Titley, superintendent of bridges and building of the Kansas City, Mexico & Orient Railway of Texas, with headquarters at San Angelo, Texas, died in that city on January 14.

C. Edward Laas, formerly engineer maintenance of way of the Chicago, Milwaukee & St. Paul, who retired in 1910, died in Chicago on January 9. Mr. Laas was born on December 7, 1857, at Morrisville, N. Y., and entered railway service in 1881 as an assistant engineer on construction on the Chicago, Milwaukee St. Paul. In 1890, he was promoted to roadmaster and in 1902, to superintendent of construction at Davenport, Iowa. He was promoted to superintendent of the Kansas City division in November, 1903, and he held this position until his promotion to engineer maintenance of way.

Construction News

The Atchison, Topeka & Santa Fe is calling for bids for the construction of an eating house at Las Vegas, N. M.

The Baltimore & Ohio has awarded a contract to the Fort Pitt Bridge Works, of Pittsburgh, Pa., for the fabrication and erection of the steel superstructure for a bridge across the Little Kanawha river at Parkersburg, W. Va., involving 2,000 tons of steelwork. The new bridge, which is to be erected under traffic, will include a 300-ft. truss span, three 80-ft. girder spans and 1,031 ft. of steel viaduct.

This company has awarded a contract to the American Bridge Company for superstructures of several bridges on its Monongah and Pittsburgh divisions. This road has also awarded a contract to the Jobson-Gifford Company, New York, for the erection of two 105-ft. plate girder spans at Jerome Jct., Pa., to the Pittsburgh Construction Company for a grade crossing structure at Feltonville, Pa.; and to the Seaboard Construction Company for new spans and the shifting of old spans in the Cheat River bridge at Point Marion, Pa.

The Cairo, Truman & Southern has applied to the Interstate Commerce Commission for authority to extend from a point on the county line of Cross County, Ark., to a connection with the Missouri Pacific near Earle, Ark., 11 miles.

The Cambria & Indiana has applied to the Interstate Commerce Commission for authority to construct a 5.08 mile extension from a point in Revloc to Cambria.

The Central of Georgia will construct a concrete and steel car shop, 200 ft. by 200 ft., at Savannah, Ga., at a cost of approximately $350,000, to replace a building recently destroyed by fire.

The Chicago, North Shore & Milwaukee (Electric) has applied to the Illinois Commerce Commission for permission to relocate its tracks through Wilmette, Ill., a suburb of Chicago, to eliminate several curves, the work to start about March 1.

The Chicago & North Western will reconstruct at once an ore dock at Ashland, Wis., which was damaged by fire to the extent of $2,500,000 on January 16.

This company will elevate its tracks at Mayfair, Chicago, at a total cost of over $1,000,000, the 1924 work to cost $600,000 and the project to be completed the following year.

This company plans the construction of extensive additions to its classification yard and car repair terminal at Proviso, Ill., the development of which will extend over a period of 10 years.

The Chicago, Rock Island & Pacific is calling for bids for the remodeling of its passenger station at El Dorado, Ark.

The Colorado, Columbus & Mexican, which was recently denied authority to build an extensive system of railroads in the southwest, has applied for authority to construct a 129 mile line from Gallup to Farmington, N. Mex.

The Detroit, Toledo & Ironton plans the construction of a new passenger station at Adrian, Mich.

The Erie plans the construction of locomotive and car shops and a power house at Hammond, Ind., to cost approximately $500,000. A coal hopper with mechanical loading equipment will also be built.

The Great Northern has awarded a contract to A. Guthrie & Company, Chicago, for the construction of seven miles of second track from Troy, Mont., to Kootenai Falls.

This company together with the Northern Pacific, has been ordered to separate grades in Minneapolis from Johnston street, N. E., to 27th avenue, a distance of over two miles. The total cost of the program will be approximately $5,000,000, of which $1,000,000 will be spent in 1924. The Great Northern will this year separate the grades at Monroe street and 19th avenue, N. E., the cost of which is estimated at $700,000. The Northern Pacific will separate the grades at 18th and 19th avenues, N. E., and Monroe street, at a cost of approximately $300,000.

The Gulf Coast Lines have awarded a contract to J. E. Walsh, Mission, Texas, for the construction of a brick passenger station at Mercedes, Texas, at a cost of $25,000.

The Hagan Coal Company has awarded a contract to John Dooley, Santa Fe, New Mexico, for the construction of a 13-mile spur track from San Felice, New Mexico, to the Hagan coal mine at a cost of approximately $300,000.

The Houston & Texas Central plans the construction of an extension to the baggage room in the station at Austin, Texas, at a cost of approximately $25,000.

The Illinois Central has completed arrangements for the construction of a frame passenger station at Carrollton avenue and Edinburgh street, New Orleans, La., to cost approximately $20,000.

The Kansas, Oklahoma & Gulf plans the construction of a freight station at Henryetta, Okla.

The Louisville & Nashville plans the construction of a freight station at New Orleans, La.

The Louisville & Nashville is reported to have awarded a contract to Doullut & Williams, Inc., New Orleans, La., for the construction of a freight station in New Orleans at an estimated cost of $500,000.

This company closed bids for the construction of a one-story machine shop, 110 ft. by 175 ft., at Etowah, Tenn., to cost approximately $55,000.

The Missouri-Kansas-Texas has issued a call for bids for the construction of a seven-story concrete warehouse, 100 ft. by 200 ft., at Dallas, Tex.

The Missouri Pacific contemplates the construction of a 125-mile extension from Bagnell, Miller county, Missouri, to Springfield, Mo. The proposal will be taken up at the next meeting of the directors, according to an announcement by President Baldwin.

The Norfolk & Western has awarded a contract to the Roberts Schaefer Company, Chicago, for the construction of a 2,000-ton, reinforced concrete, 6-track, automatic coaling and sanding station, with duplicate elevating equipment, at Prichard, W. Va., to cost $151,000.

The Northern Pacific has prepared plans for the construction of repair shops and a power house at Brainard, Minn., estimated to cost approximately $600,000, including equipment. This work is part of the general improvement program reported in the January issue. See Great Northern.

The Oklahoma Union plans the construction of a car repair shop and a power house at Tulsa, Okla.

The Oregon-Washington Railroad & Navigation Company has applied to the Interstate Commerce Commission for authority for the construction and operation of a 3-mile line in Umatilla county, Ore., as a branch to the village of Umapine. The commission has issued a certificate for the construction of a branch line from Crane to Burns, Ore., 30 miles, to connect with the Oregon Short Line.

The Philadelphia & Reading has awarded a contract to the James McGraw Company, Philadelphia, for the grading in connection with a change in alinement of its main line south of Port Clinton, Pa. This work will require the excavation of approximately 330,000 cu. yd. Upon completion of the contract two river bridges and pulpit Rock tunnel will be abandoned.

The Pueblo Conservancy District closed bids on January 15 for the relocation of 35 miles of railroad track at Pueblo, Colo., the construction of a re-located river channel and a barrier dam 6 miles west of Pueblo. The flood control work at Pueblo is being carried on through the Dayton Morgan Engineering Company, Dayton, Ohio.

The Snow Hill has applied to the Interstate Commerce Commission for authority to construct a line from Hookerton to Snow Hill, N. C. J. T. Hagans, of Tarboro, N. C., is general counsel of the company.

The Southern plans the construction of a one-story addition to its locomotive and car repair shop, 100 ft. by 130 ft., at Ferguson, Ky., and has awarded a contract to the Dwight P. Robinson & Company, New York, for the design and construction of additons to its shops at Birmingham, Ala., the work to include locomotive repair shops, boiler and black-

smith shop, car repair sheds, mill shop, power plant and other buildings.

The company is calling for bids for the construction of a one-story mill building, 80 ft. by 200 ft., at Princeton, Ind.

The Southern Pacific will construct a storehouse at El Paso, Texas, to cost approximately $40,000, and has awarded a contract to C. A. Fellows of Los Angeles, Cal., for the construction of a one-story locomotive erecting shop, 85 ft. by 498 ft., at Los Angeles, Cal., reported in the September issues.

This company has awarded a contract to the Utah Construction Company, San Francisco, Cal., for grading a new line through Yuma, Ariz., at a cost of $660,000.

The Union Pacific has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a 150-ton automatic, three-track, shallow pit type locomotive coaling plant and sand handling plant at Orchard, Idaho.

The Wabash plans the construction of new shops and yard two miles west of Peru, Ind., at an estimated cost of $1,000,000.

Equipment and Supplies

The Minneapolis & St. Louis has ordered 5,000 tons of rails from the Inland Steel Company.

Edwin P. Morrow, former governor of Kentucky, was sworn in as a member of the United States Railroad Labor Board in Chicago on January 16. Mr. Morrow, who is a member of the public group of the board, succeeds Judge R. M. Barton of Tennessee.

The Canadian National has opened a radio station at Calgary, Alta., from which musical and other programs will be broadcasted. Receiving sets are now in operation on the transcontinental trains of the National lines and it is the intention of the company to install similar sets in its hotels.

It is expected that Mexico's first electrified section of steam operated railroad will be ready to operate in March. This project consists of 30 miles of single track on the main line of the Mexican Railway Company between Mexico City and Vera Cruz, to be operated by ten 150-ton, direct current locomotives built by the General Electric Company.

The Safety section of the American Railway Association has announced that a prize of $500 will be paid to the person submitting, before February 11, the best poster for use in the careful crossing campaign during the coming season. The sum of $200 will be given as second prize and the sum of $100 as third prize. In addition to these prizes $100 will be paid to the person submitting the best slogan for the campaign.

It is estimated that the expenditure of at least $7,870,000,000 will be required by the railroads during the next 10 years for facilities to enable them to handle the increased traffic properly, according to a report made by the Chamber of Commerce of the United States. The estimate was based on reports from 62 roads operating 166,810 miles, or 64.6 per cent of the total mileage and handling 67.6 per cent of the total freight traffic in 1922.

The statistics of the Interstate Commerce Commission for November, 1923, disclosed that in that month the tax accruals of Class 1 railroads amounted to $30,386,092, or at the rate of $1,012,870 a day. This is the first month in history when their tax accruals exceeded $1,000,000 a day. The taxes amounted to $27,284,000 for November, 1922, $25,042,000 for 1921, $22,343,000 for 1920, $18,820,000 for 1919 and $15,910,000 for 1918. Since 1919 the taxes paid by the railroads have regularly exceeded the dividends paid by them, the taxes of the Class 1 roads in 1922 exceeding their dividends by $34,000,000. The total taxes of these roads for 1923 are estimated at over $330,000,000, which, if they continue to increase in 1924 as in 1923, will amount this year to approximately $365,000,000, which will exceed the dividends paid by them in any year since 1914 and will be equivalent to a dividend of five per cent on all their outstanding stock.

Supply Trade News

General

The Inland Steel Company has purchased the Milwaukee Rolling Mill Company, Milwaukee, Wis.

The Allegheny Steel Company, Brackenridge, Pa., has opened an office at 855 Peoples Gas building, Chicago, in charge of **Banks E. Eudy.**

The Bureau of the Census is now engaged in collecting statistics of manufactures covering the calendar year 1923. The schedules have been prepared after conferences with various industries, and have been mailed to the manufacturers. The Director of the Census requests the prompt return of all reports. If reports are not made by mail it will be neccessary for the government to go to the expense of sending a special agent to the various establishments.

The Pawling & Harnischfeger Company, Milwaukee, Wis., has opened new offices in the south. **N. B. Norris,** formerly district manager at New Orleans, has been appointed district manager at Memphis, Tenn. **D. J. Murphy,** formerly in the New Orleans office, has been appointed district manager of the Texas district, with headquarters at Dallas, Tex. **F. W. Truex** will continue as district manager at Atlanta, Ga., with offices at 212 Haas Howell building. **W. J. Dugan** has been appointed southern sales manager, with headquarters at Memphis, Tenn.

Personal

A. R. Eitzen, engineer of **The Stroebel Steel Construction Company,** has been promoted to chief engineer, succeeding **T. R. Rall,** deceased.

S. W. Buckner has been appointed eastern representative of the Lumberjack Company, Portland, Ore., manufacturers of lumber for railroads, with headquarters at 6 N. Michigan Ave., Chicago.

R. E. Ludwick, formerly sales manager for the Cleveland Crane & Engineering Company, Wickliffe, Ohio, has joined the sales staff of **Whiting Corporation,** with headquarters at 945 Monadnock block, Chicago, Ill.

E. C. Temple, formerly associated with the Western Equipment Company, has been appointed general sales manager of **A. H. Talbot & Company,** dealers in railway and contractors' equipment, with headquarters at Chicago.

G. E. Gaylor has been appointed district manager of the Chain Belt Company, Milwaukee, with headquarters at San Francisco, Cal., and **J. V. McDonald** has been appointed district manager with headquarters at Los Angeles, Cal.

A. M. Thomson has been appointed Philadelphia district representative of the Hauck Manufacturing Company, with his office at the Bourse, succeeding **R. B. Ecker,** resigned. Previous to his appointment, Mr. Thomson represented the Hauck Manufacturing Company in northeastern Pennsylvania, Canada and New England.

C. H. Davies for many years in the service of **S. F. Bowser & Co., Inc.,** Fort Wayne, Ind., as manager of its factory division in Chicago, has assumed charge of the factory sales promotion division of the entire Bowser organization, with headquarters in Fort Wayne. Mr. Davies relieves L. E. Porter, assistant general manager, of this branch of the promotion service and now works in collaboration with T. D. Kingsley, general sales manager of the company.

F. F. Kister, secretary and treasurer of the Q. & C. Company, New York, who has been connected with the company since 1895, has been elected president, succeeding **Charles F. Quincy,** who has been elected chairman. **Edgar M. Smith, Richard J. McComb, James L. Terry** and **Lester T. Burwell,** have been elected vice-presidents, with offices at Baltimore, Md., Chicago, St. Louis, Mo., and New York, respectively, and **E. Ray Packer** has been elected vice-president in charge of manufacturing. **Marinus Iseldyke, Jr.,** has been elected

secretary and assistant treasurer, **Ralph R. Martin**, auditor and **Chester A. Gaskill**, assistant secretary and cashier.

Robert D. Sinclair, executive vice-president of **Mudge & Company**, Chicago, has been elected president to succeed **Burton Mudge**, who has been elected chairman of the board of Mudge & Company in addition to his duties as executive vice-president of the Bradford Corporation. **Albert C. Force**, treasurer and assistant general manager in charge of production and stores with headquarters at Chicago, has been promoted to vice-president and treasurer in charge of the manufacturing, purchasing and treasury departments. **John G. Abplanalp**, production engineer, has been promoted to secretary to succeed Arthur L. Pearson, who has been elected assistant vice-president of the Bradford Corporation. **Mr. Sinclair** was born at Chicago, on April 12, 1878, and entered railway service with the Chicago & Eastern Illinois in 1892. In 1893 he entered the operating department of the Columbian Intramural Railway at the Chicago World's Fair. At the close of the exposition he entered the service of the Union National Bank of Chicago, where he remained until its consolidation with the First National Bank in 1900. He held several positions with the latter institution until September 1, 1910, when he became secretary and treasurer of Mudge & Company. On January 12, 1912, he

Robert D. Sinclair

Albert C. Force

John G. Abplanalp

was elected second vice-president and later was made first vice-president which position he held until November 1, 1916. On the latter date he was elected executive vice-president which position he has held until his recent promotion. **Mr. Force** was born at Chicago, on September 19, 1886, and previous to his connection with Mudge & Company was auditor of a concern operating a chain of stores in Chicago. He became associated with Mudge & Company in January, 1918, as assistant treasurer, and on March 15, 1918, was promoted to treasurer and was placed in charge of all purchases. On January 1, 1923, he was appointed assistant general manager in charge of production and stores in addition to his duties as treasurer, which position he has held until his recent promotion. **Mr. Abplanalp** was born at LaCrosse, Wis., on April 1, 1891, and in 1910 entered the employ of the Stayright Engine Company as a storekeeper and cost accountant with headquarters at LaCrosse. He held this position until 1916, when he entered the United States Army to serve on the Mexican border and later served as an officer in the infantry during the World War. He left military service in 1919 and entered the employ of Mudge & Company on January 5, 1920, as cost accountant. In 1921 he was appointed production engineer, which position he has held until his recent promotion.

Trade Publications

Concrete Breaker.—A bulletin, No. 81-D, of eight pages has been prepared by the Sullivan Machinery Company, Chicago, describing and illustrating an air operated hammer drill designed for breaking up concrete floors, walls, etc. The bulletin includes full specifications.

Motor Car Equipment.—Bulletin No. 155 has been issued by the Fairmont Railway Motors, Inc., Fairmont, Minn., containing a list of the parts and equipment manufactured by this company for motor cars. This list includes motor car chasses, housing seats, trailers of various kinds, safety railings of various kinds, wheels, axles, etc. The bulletin is well illustrated.

Traveling Cranes.—An eight-page pamphlet has been issued by the Whiting Corporation, Harvey, Ill., concerning its power and hand operated traveling cranes and bucket handling trolleys. Several illustrations show the various types of cranes in use, as well as the detailed construction of the cranes. The pamphlet also includes a large list of companies which have installed Whiting cranes.

Waterproof Paint.—Under the title of "75 Years," Toch Brothers, New York City, have recently issued a large size, 12-page, illustrated booklet as a souvenir of their seventy-fifth anniversary in the manufacture of R. I. W. preservative paints and compounds. The first part of the text describes briefly the founding of Toch Brothers. This is followed by a partial list of well known structures protected by this company's products, as well as some of the principal accomplishments which have been achieved.

Oxy-Acetylene.—The Air Reduction Sales Company, 342 Madison avenue, New York, has issued a 12-page booklet entitled "The Care of Oxygen and Acetylene Cylinders," for distribution among users of such equipment with a view to promoting the most efficient handling of this equipment and particularly to promote safety in the handling of both empty and filled cylinders by welders. In discussing the subject, each point is taken up separately to afford easy reference and to avoid confusion in meaning.

Air Compressors.—The Sullivan Machinery Company, Chicago, has prepared bulletin No. 77, describing portable air compressors of three types, a gasoline engine driven type, a type driven by a belt from an electric motor and a type driven by a belt from a tractor. The bulletin, which contains 16 pages, includes considerable information concerning the adaptability of the equipment as well as specifications. Illustrations are furnished showing the different parts of the machinery and its method of operation in service.

Wrought Pipe.—The National Tube Company, Pittsburgh, Pa., has recently issued a small size, 16-page, illustrated booklet descriptive of the tests to which the pipe manufactured by this company had been submitted through accident. The booklet, which has been given the title "The Seven Wonders of Wrought Pipe," describes in detail such incidents as the blowing out of over 3,000 ft. of 3-in. drill pipe from an oil well with the result that although the pipe coiled and twisted all over the surrounding area, no joints were broken. The other incidents are of a somewhat similar nature. The condition of the pipe is shown in the illustration.

Stainless Steel.—The Firth Stainless Steel Company, Keysport, Pa., recently issued a 62-page, illustrated book, descriptive of the purpose and applications of stainless steel and iron. The various applications of stainless steel are listed, as well as a detailed description of the methods of forging, annealing, hardening, tempering of stainless steel and stainless iron. The various physical properties of this material are also given in detail so that any form of calculation for the use of it can be readily carried out. The illustrations show a number of its practical uses such as ball ball bearings, steel plates, electrical appliances, engine and compressor fixtures, etc.

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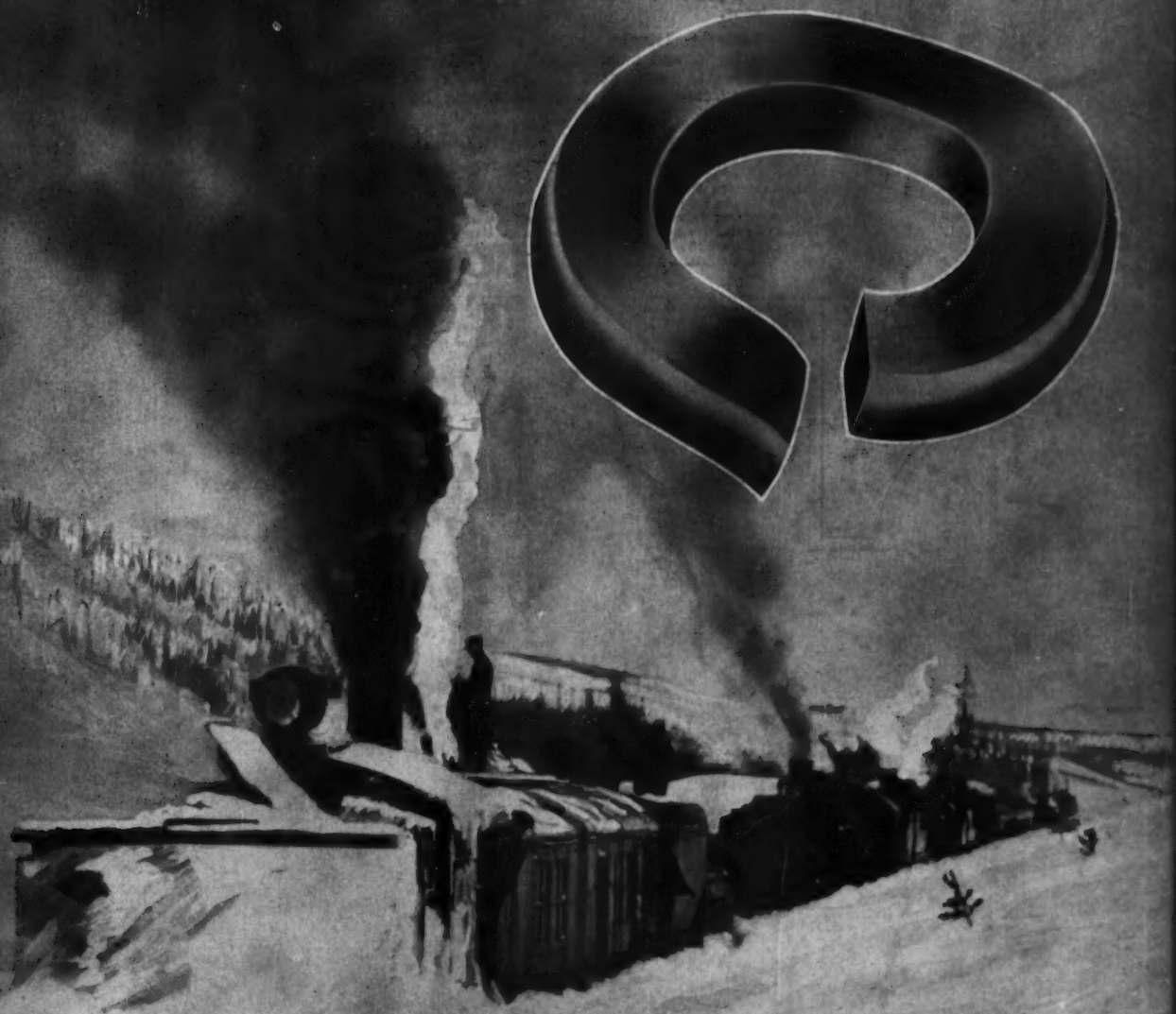
Railway Engineering and Maintenance



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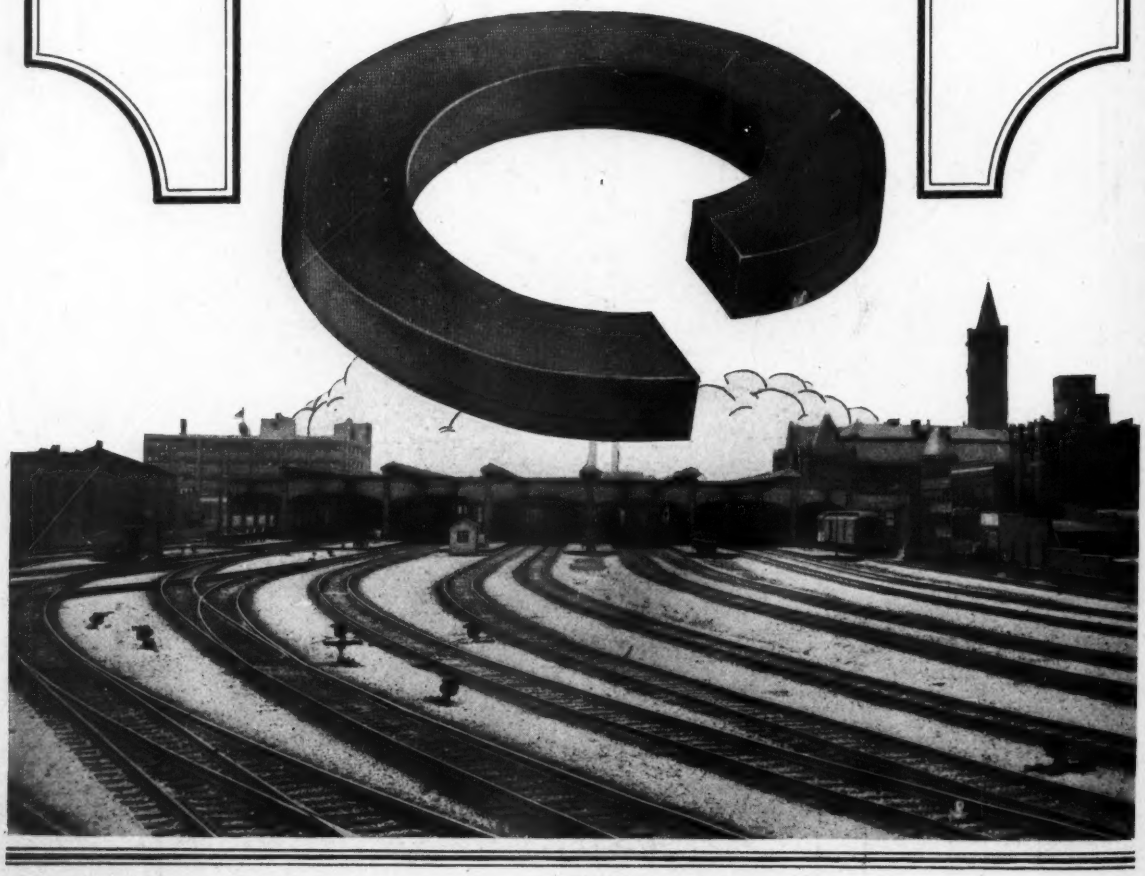

RAILWAY ENGINEERING AND MAINTENANCE

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Alphabetical Index to Advertisements, Page 34 Classified Index to Advertisers, Pages 32 and 34

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THAT, after all is what you really want—efficiency in track work. Motor cars are track tools and should be so regarded.

Therefore, they must be simple, rugged, easy to understand and built to stand up under both ordinary and unusual conditions.

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Standardize *on the* Tank that Does 3 Things

THERE never was a tank to rely on like the Horton conical-bottom. Why? Because it has a canny knack of being useful almost anywhere. Primarily, it is used for water treatment, water settling and roadside delivery.

In these three uses it has no equal. No other design will meet the exacting requirements of railroad maintenance engineers. In popular parlance, the Horton conical-bottom "delivers the goods."

For Removal of Suspended Matter

Horton conical-bottoms have lately been used successfully to remove finely divided matter in suspension in water for railroad boilers. The Yazoo and Mississippi Valley Railroad has installed these conical-bottoms for the sole purpose of removing the suspended matter encountered in water at Baton Rouge, Louisiana. Scale-forming solids were almost entirely absent, and the conical-bottom tank was chosen as the best means of settling out the suspended matter. The ease of sludge removal was an important factor in the selection.

The conical-bottom made this water entirely satisfactory for boiler use. The installation needs little care, for it functions entirely by the sure force of gravity.

For the Softening System

Where scale-forming solids are found in the water supply, softening becomes necessary to get best results. Our engineers have worked out Horton conical-bottom installations which are proving to railroad men the superiority of this tank in water treatment. The advantage of using the conical-bottom is that there is no dead water space—the entire volume of the tank is used and all the water is thoroughly treated. Excessive sludge is easily removed. Timed opening of the wash-out valve retains just enough suspended matter to make the reaction of the treating thorough. The cost of sludge removal is less than in most other systems.

(*Note:—Do not confuse the Horton* ***conical-bottom*** *with the old unscientific cone-bottom.*)

For Roadside Delivery Service

Because they last indefinitely, because they do not leak, because they are not affected by the climate or the weather, because they cannot burn, rot or fail from other causes, and because they require no maintenance except painting every three or four years, Horton *all-steel* elevated tanks provide a long-run economy which more than one hundred leading railroads are taking advantage of.

Installation of a Horton conical-bottom *steel* tank for roadside delivery purposes relieves the railroad official from worry, because we assume responsibility for materials and workmanship. The steel tank is cheapest in the end; the conical-bottom steel tank gives the best service during its long life.

Chicago Bridge & Iron Works

251 CHICAGO 2452 Old Colony Bldg. DALLAS 1646 Praetorian Bldg. SAN FRANCISCO 1007 Rialto Bldg. NEW YORK 3156 Hudson Terminal Bldg. ATLANTA 1036 Healey Bldg.

Relocation on the Frisco Eliminates an Old Tunnel.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 20 February, 1924 Number 2

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What tie producers say about market conditions?

How to operate a steam hammer under water?

The effect of mixing oil with creosote?

What the Japanese earthquake did to the railroads?

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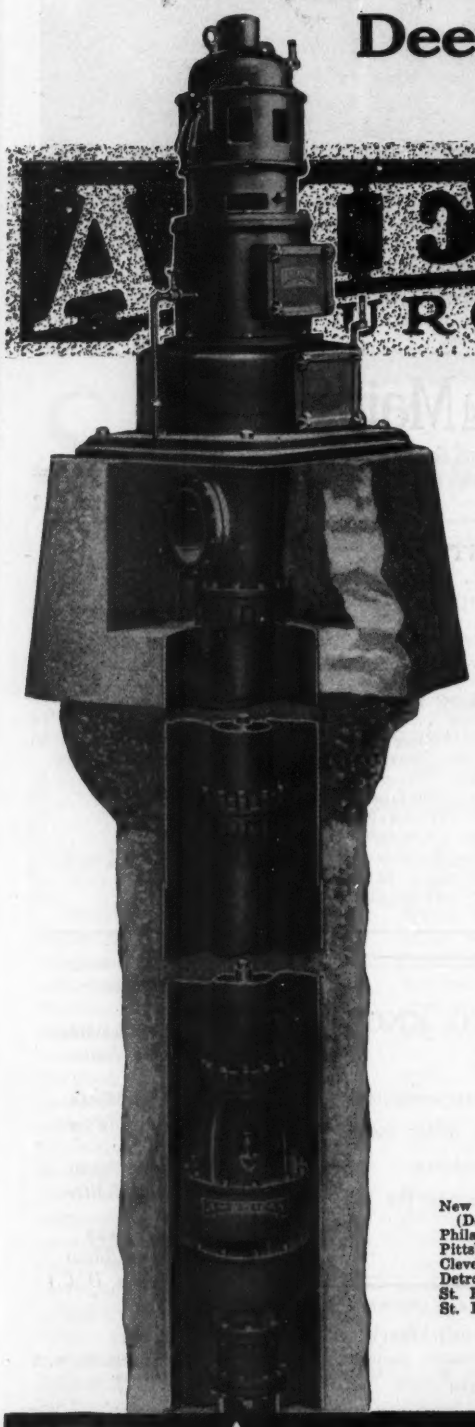
Announcing the "American" Totally Enclosed Deep Well Turbine Head!



AMERICAN
AURORA, ILL.

Totally enclosed, this new motor driven head has great rigidity of construction, and counteracts any vibration from moving parts in the turbine.

It is equipped with Kingsbury water cooled thrust bearing, and provision is made for complete drainage of all waste oils and water. The discharge in this new design is located below ground, which makes for an unusually compact and neat installation.

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No. 3 of a Series

Name of Railway: M. St. P. & S. Ste. M. R. R. (Soo Line).

Location: Main line, Minneapolis to Chicago.

Traffic: Heavier than average, passenger and freight.

Installation Data: Two 12 ga. 48 in. ARMCO Culverts, single riveted. Fill, about 4 ft. of sand. Installed in 1910.

Condition: Slight settlement of joint has caused little elevation at both intake and outlet. Otherwise in excellent condition. Photographed and inspected April 15, 1922.

Remarks: Double riveting is now specified for this type of installation. Also, in sand, or soils of low bearing value, it is recommended that pipe be installed on a camber to allow for settlement under concentrated load of fill and traffic. In some cases, a foundation of gravel or crushed stone is indicated.

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And, the soundness of using Cyclone Galv-After Chain Link Fence is recognized as equally important. For this means fence will last years longer without annual upkeep expense. The first cost is the last. There is no expensive painting annually, etc.

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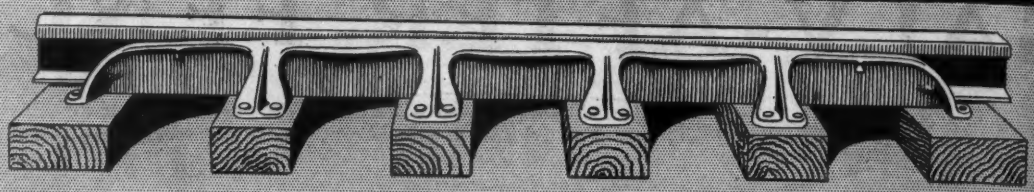

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ONE-PIECE GUARD RAIL

Ramapo and **Ajax** specialties have been long and favorably known under their individual names as manufactured by Ramapo Iron Works and Ajax Forge Company. These two companies are now consolidated into Ramapo Ajax Corporation, with five completely equipped works conveniently located for prompt deliveries to the railroads of the country. To assure service in the Western territory a stock of Ramapo Automatic Safety Switch Stands is carried at the Chicago headquarters.

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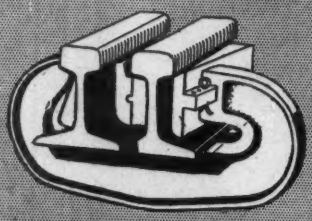
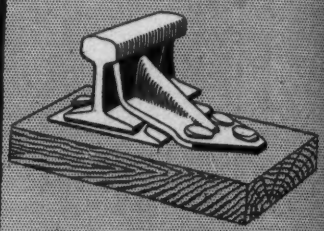
Other "RACOR" specialties not here illustrated include Switches, Frogs, Crossings, etc., Special Railway Track Work, Cast and Rolled Manganese Rail Construction, etc.

Particular attention is directed to the Ajax One-Piece Guard Rail at top of this page. Its combined simplicity and rigidity make this the most efficient and economical installation.



RACOR FORGED
HEAVY DUTY
GUARD RAIL CLAMP



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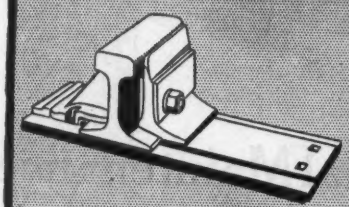
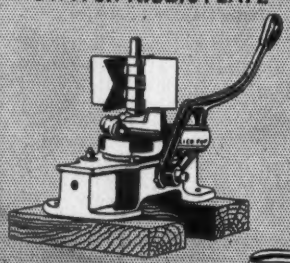
FORGED RAIL BRACE



RACOR DOUBLE SHOULDER
SOLID BOTTOM
SWITCH RISER PLATE



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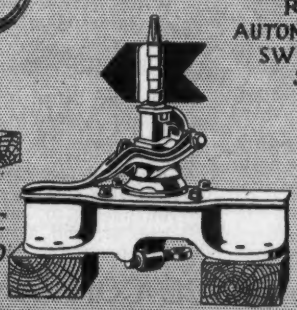
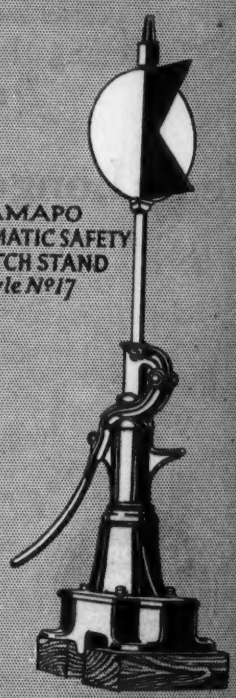
SAFETY SWITCH STAND
Style No 20-B



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No 19

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No 18



RAMAPO
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SWITCH STAND
Style No 17

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Save on every mile

"Selflock" track bolts are a complete track fastening. When using "Selflocks" you buy shorter bolts and no locking device. In applying "Selflocks" there is nothing to adjust, fix, or break. Over any combination requiring a locking device, "Selflocks" show a considerable saving on every mile of track.

Regularly furnished on the highest grade of Heat Treated steel, "Selflock" track bolts are an absolute guarantee against bolt stretching and loose joints.

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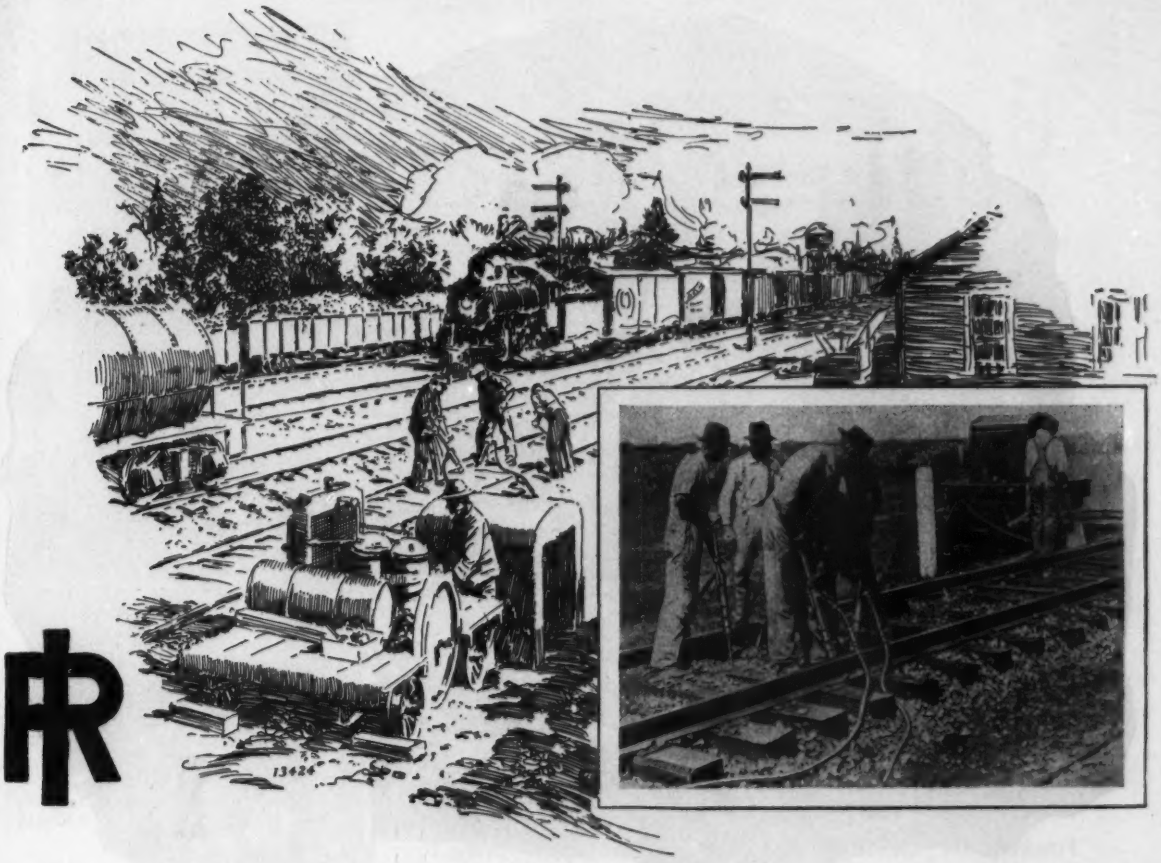
BETHLEHEM STEEL CO.
BETHLEHEM, PA.

SELFLOCK

Track Bolts — Machine Bolts — Crossing Bolts



NEW STANDARDS IN TRACK EFFICIENCY

Pneumatic Tie Tampers, first of all, tamp the track so that it stands up two to three times as long as hand tamped track. The track is also more uniform and smoother.

The better track is obtained with less labor and in less time. Four men with Pneumatic Tampers will tamp more track in a day and do a better job than sixteen men with ordinary picks and bars.

Better track, that lasts much longer, produced with less labor and in less time and with a resulting saving in the final costs, is the reason for the adoption of Pneumatic Tampers as the standard equipment for hundreds of track maintenance gangs.

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Offices in all Principal Domestic and Foreign Cities

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173TT

Ingersoll-Rand

Loading one of the bore holes for the big Frazier blast.

Blasting 250,000 tons of stone

A record quarry shot in the South with du Pont dynamite

WHEN the Chesapeake & Ohio Railroad needs ballast they start a young earthquake and shake down a hill to get it.

In what is believed to be the largest quarry shot ever made in the South, a quarter of a million tons of stone recently were thrown down and well broken at the Frazier Ballast Quarries, Frazier, West Virginia.

Fifty-eight thousand pounds of du Pont explosives were used on the job—42,000 pounds of 60% Gelatin and about 16,000 pounds of Red Cross Extra 40%. Cordeau Bickford was used throughout as a detonator with trunk line connection. Including explosives and labor, this shot cost nearly $30,000.

The blast consisted of 71 well-drilled holes varying in depth from 30 feet to 157 feet. The holes were spaced 16 feet apart and set back from the face of the quarry on an average of 24 feet.

J. R. Anderson, of the C.&O. Road, was superintendent of operation and S. R. Russell, of the Technical Section of the du Pont Company, directed the loading and firing of the shot.

E. I. DU PONT DE NEMOURS & CO., Inc., Wilmington, Delaware

Explosives Department

Du Pont Products Exhibit, Atlantic City, N. J.

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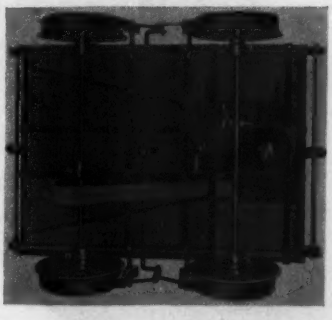
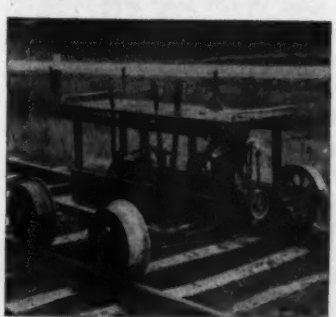
Showing portability of Casey Jones, Hyatt equipped, standard section motor car No. 520.



Bottom of above car No. 520 showing drive and location of five Hyatt roller bearings.

Casey Jones heavy duty car No. 550. Has Ford engine and Hyatt bearings.



Hyatt bearings also on this Casey Jones inspection motor car No. 535. These cars are all manufactured by the Northwestern Motor Co., Eau Claire, Wis.

Casey Jones Standardizes On Hyatt Roller Bearings

The Northwestern Motor Company, Eau Claire, Wis., in producing its high grade and economical Casey Jones railway service cars, has standardized on Hyatt roller bearings.

These cars are real fuel and power savers due largely to the fact that the Hyatt bearings alone reduce the power requirement over 50% on level tracks.

Lower lubrication cost is another important feature of Hyatt bearing cars. They require lubricant only three or four times a year which results in less oil or grease used and far less lubricating labor than required by plain bearing cars.

Hyatt bearings once installed are there to last the life of the car, without replacement or adjustment. Bearings taken down after years of service under all conditions fail to show noticeable wear.

Add to these advantages, easy starting, smooth running, and general carefree operation and you have an idea of what Hyatt bearing equipped service cars mean.

Don't be handicapped by plain bearing equipment. Dispose of your service car troubles by specifying Hyatt roller bearings.

Hyatt bearings can also be had for heavy equipment, both electric and steam. Write for complete information.

HYATT ROLLER BEARING COMPANY

NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER MILWAUKEE HUNTINGTON
MINNEAPOLIS PHILADELPHIA CLEVELAND
PITTSBURGH BUFFALO INDIANAPOLIS

The "STEP"

Note how the edge of the shovel is stepped, or turned over. This new feature not only aids the workman, but eliminates that soreness often caused in wet weather by pushing the foot on a sharp edge.

Another revolutionary improvement will be announced in April. Watch for it!

ACCLAIMED

the greatest shovel improvement in fifty years

An immediate favorite with the men, too!

TALK about enthusiasm for a tool—you should see the men who have tried the new Wood's Mo-*lyb*-den-um Step Shovel. They say it's the greatest shovel improvement in 50 years.

It certainly makes the shovel easy on the feet. One man estimated that it would save at least a pair of shoes a year per man. It gives a greater purchase to the foot. The Step makes it possible for each man to do more work with apparently the same effort.

This new shovel is made of Mo-*lyb*-den-um, the toughest, strongest and most flexible of steel. The Step, or turned-over edge, gives added stiffness and strength to the blade. It makes the strongest of shovels still stronger. The handles are selected, seasoned second-growth northern ash.

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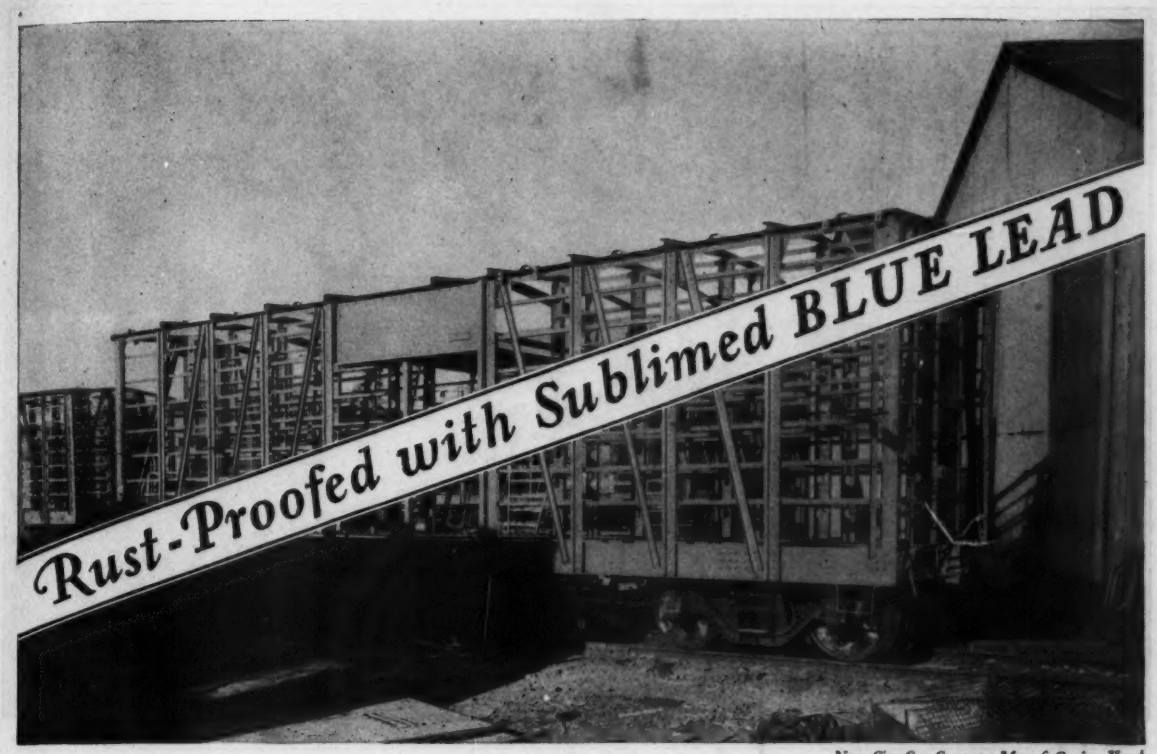
Let us give you immediate information about this new Step shovel, and its application to your needs. Write to-day to

THE WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio, U. S. A.

Wood's Mo-lyb-den-um Shovels
The American Super Steel



New City Car Company Manufacturing Yard

Extending the Use of Sublimed Blue Lead to Rolling Stock

IN many places in the railway field Sublimed Blue Lead in Oil is rust proofing and protecting bridges and viaducts. Sublimed Blue Lead protects iron or steel against corrosive gases, wind, rain, snow and the extremes of temperature. The New City Car Company is now using Sublimed Blue Lead in Oil on the all steel work in the cars that they build for the Live Poultry Transit Company.

A hundred pounds of Sublimed Blue Lead will rust proof 5216 square feet of iron or steel. This is equivalent to a surface a foot wide and nearly a mile long. It is double the performance expected from the pigment most used for rust-inhibitive purposes.

Sublimed Blue Lead in Oil works so smoothly and so easily under the brush that a painter can cover a greater area in a day and still produce a paint film free from brush marks, breaks, runs, or alligatoring. It flows smoothly over the metal surface, sinks into joints and seams and around rivet heads. Gripping tightly to the metal surface it takes subsequent coats well.

Sublimed Blue Lead in Oil will not harden in the container.

The durability of Sublimed Blue Lead as a long time protector of metal surfaces has been proven both in the field and in technical tests.

Write for your copy of "Fighting Rust with Sublimed Blue Lead."

The EAGLE-PICHER LEAD COMPANY · 856-208 *South La Salle Street* · CHICAGO

EAGLE *Picher Sublimed* BLUE LEAD *in* OIL

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Plants: CINCINNATI NEWARK GALENA, KAS. HENRYETTA, OKLA. PICHER, OKLA.
EAST ST. LOUIS, ILL. CHICAGO ARGO, ILL. JOPLIN, MO. HILLSBORO, ILL. (2 *Plants*)

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1

BUILT FROM THE GROUND UP IN ONE PLANT

All Units of INDUSTRIAL locomotive cranes are built completely in one plant, which assures perfect control of design, workmanship and delivery. Raw materials are cast, forged, machined and assembled under the guidance of chemical and physical laboratories, and are subjected to hundreds of inspections during their progress.

2

ASSEMBLED AND TESTED BEFORE SHIPMENT

Every INDUSTRIAL locomotive crane is completely assembled and thoroughly tested under its own power on a well-equipped test track before shipment. Full capacity loads are handled under actual and severe service conditions and all other functions thoroughly tested. A certificate of the test accompanies each crane.

Supreme in Railroading

INDUSTRIAL cranes are in use on over 420 different railroads in the United States, Canada, Mexico, South America, Japan, China, Australia, India, Russia, France and Cuba. One railroad alone owns 214 INDUSTRIALS.

The general construction of INDUSTRIALS explains their representation in such great numbers in railroad service. The frame work of heavy castings with shafting accessibly arranged for easy removal, and with no bearing cap pull, is of a highly superior type. The unit type baseplate supports all propelling mechanism, eliminating all bolted or studded brackets which might work loose in service. The propelling mechanism is also of superior design.

Equipped with scale-proof boilers, independent automatic bucket drums, sliding beam-type outriggers and many other excelling features, INDUSTRIALS are unequalled for railroad service.

A copy of the 164-page Golden Anniversary Catalog, illustrating and describing the 17 types of INDUSTRIAL cranes and other material-handling equipment, will be forwarded promptly upon request.

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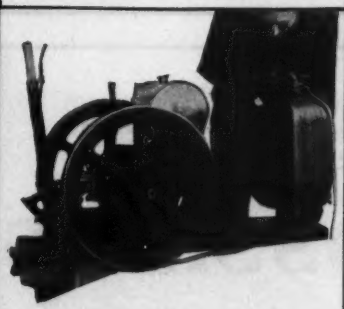
BAY CITY - MICHIGAN

Locomotive Cranes, 5 to 200 Tons -- Transfer, Pillar & Gantry Cranes
Railway Pile Drivers -- Combination Crane Pile Drivers -- Transfer Tables
Portable Rail Saws -- Grab Buckets -- Magnets -- Steam Pile Hammers

INDUSTRIAL LOCOMOTIVE CRANES

M2—SECTION CAR

Reasons for Fairmont Leadership and Economy



Freeze-proof Removable Water Jacket

Non-spattering, closed type with undercar overflow. Capacity large enough for twenty to sixty miles operation depending on loads hauled. The simplest, ruggedest, safest cooling system for section cars.

Note These Figures:

Time: A month in 1923
Place: Class 1 Railroad in U. S. A.
Performance: 400 Fairmont Section Cars (average age 5 to 6 years) carried an average of 7.3 men with tools and trailers over 100,000 miles of track.
Cost per 100 miles:

Operation	$1.08
Maintenance	1.31
Overhead	1.02
TOTAL	$3.41

Performance on the Job Counts

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In constant use on the important railways in every State, Fairmont Motor Cars play an important part in America's transportation system.

Long, specialized study and experience in all details of railway service, enable Fairmont builders to show what this branch of the service can do to raise the standard of general efficiency all along the line.

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Fairmont

Ball-Bearing Engines and Railway Motor Cars

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DANGER points should be marked with danger signals. The ends of stub tracks should be protected with Durable or Ellis bumping posts. Even green switchmen or trainmen know the meaning of these sturdy posts. They know it is very difficult to conceal the results of careless handling of cars when these posts stand guard. Discipline is made easy when Durable and Ellis Posts are the standard.

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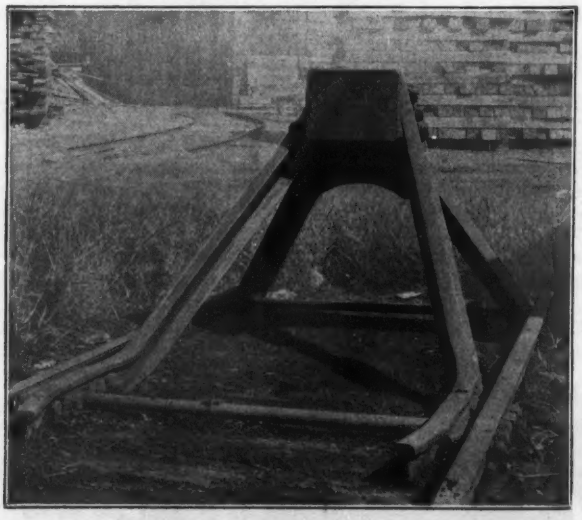

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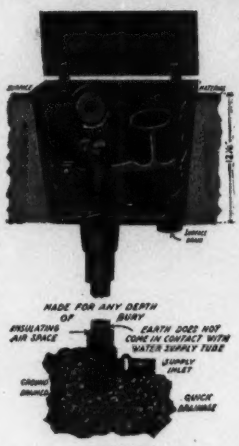
Pershing Road and Loomis Street CHICAGO

MURDOCK
WATER SERVICE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INSULATING AIR SPACE
EARTH DOES NOT COME IN CONTACT WITH WATER SUPPLY TUBE
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Anti-freezing—fool-proof.

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Chicago, 409 Monadnock Block Building
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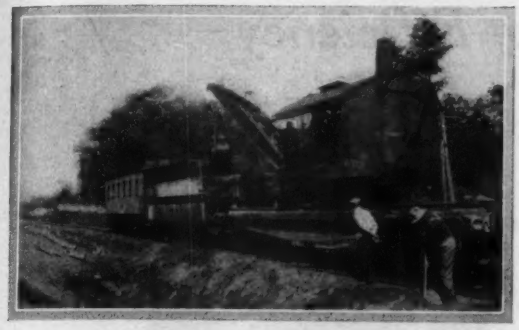

Ditching on Maine Central Railroad. Loading Western 20-yard air dump cars, using clamshell bucket. Note Extension Floor or Apron.

They all use *Westerns*

Western

That's Why

Western Dump Cars for Service

The work to be done determines the size of the dump car required. Service alone should determine the make. Whatever the size, the make should be *Western*, for the simple reason that Western dump cars will do more work for less money than other dump cars. Don't rely on blue prints alone. Find out what the relative performance has been of the cars under consideration. We challenge comparison in service as to both production and cost of upkeep.

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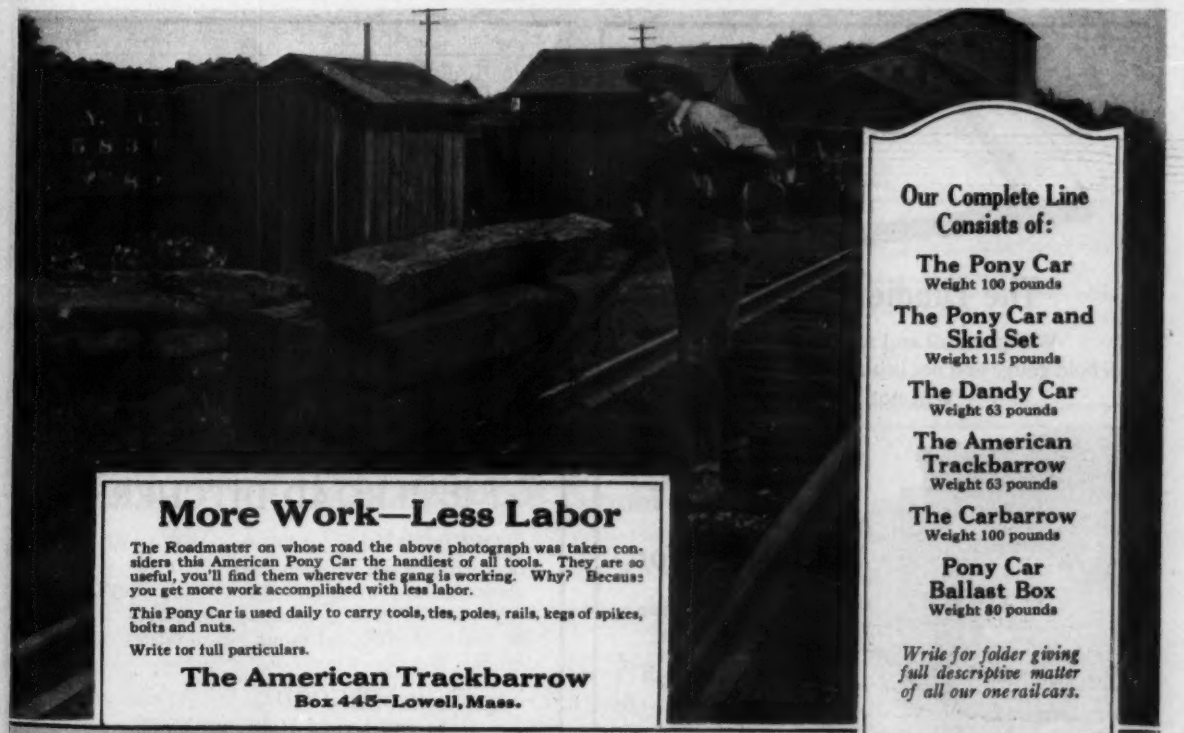
Aurora, Illinois



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The Roadmaster on whose road the above photograph was taken considers this American Pony Car the handiest of all tools. They are so useful, you'll find them wherever the gang is working. Why? Because you get more work accomplished with less labor.

This Pony Car is used daily to carry tools, ties, poles, rails, kegs of spikes, bolts and nuts.

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Box 445—Lowell, Mass.

Our Complete Line Consists of:

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Weight 100 pounds

The Pony Car and Skid Set
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Weight 63 pounds

The American Trackbarrow
Weight 63 pounds

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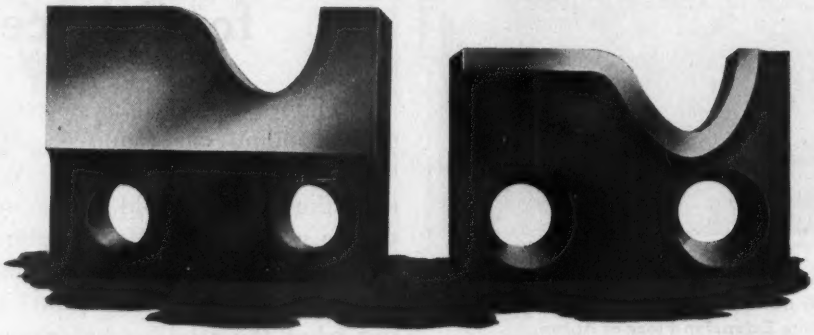
Pony Car Ballast Box
Weight 80 pounds

Write for folder giving full descriptive matter of all our one rail cars.

AMERICAN TRACKBARROW

For Maximum Cutting Efficiency—



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Bethlehem Special High Speed Tool Steel has been developed to the point where the maximum cutting efficiency is obtained in rough turning, forming and finishing the flange and tread of brake hardened locomotive tires, tank and car wheels, etc.

We will be pleased to furnish and demonstrate Bethlehem Special High Speed Tool Steel for rough turning tires or for forming tools as illustrated above, and on receipt of blue print or sketch giving detailed dimensions we will be pleased to estimate and quote prices on finished forming tools, hardened, ready for use.

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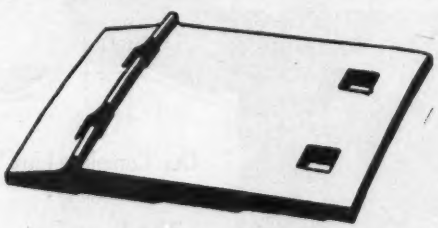

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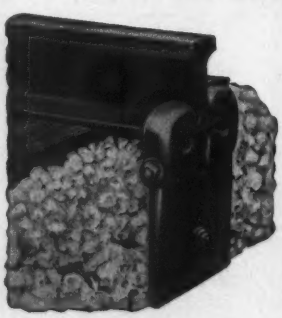

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Will hold in both directions.

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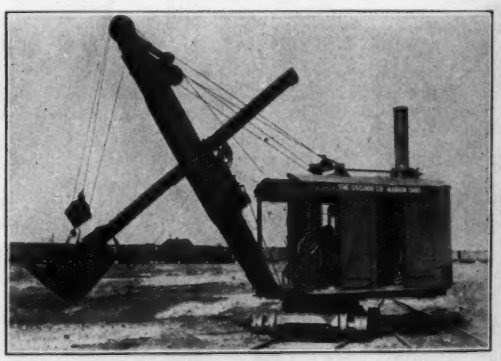

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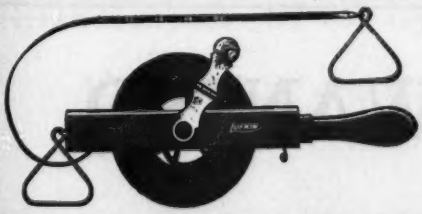

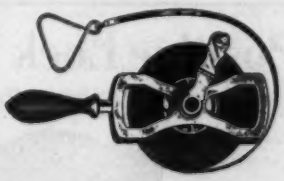

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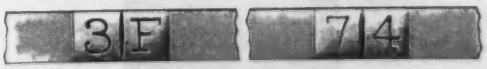

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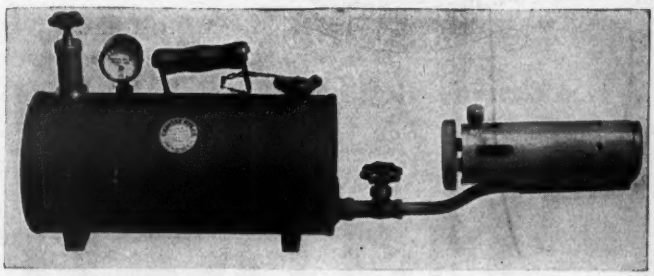

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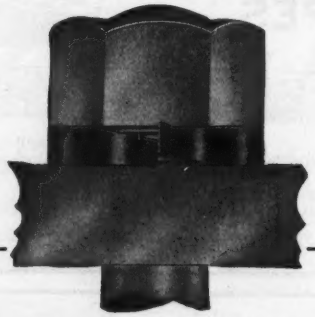

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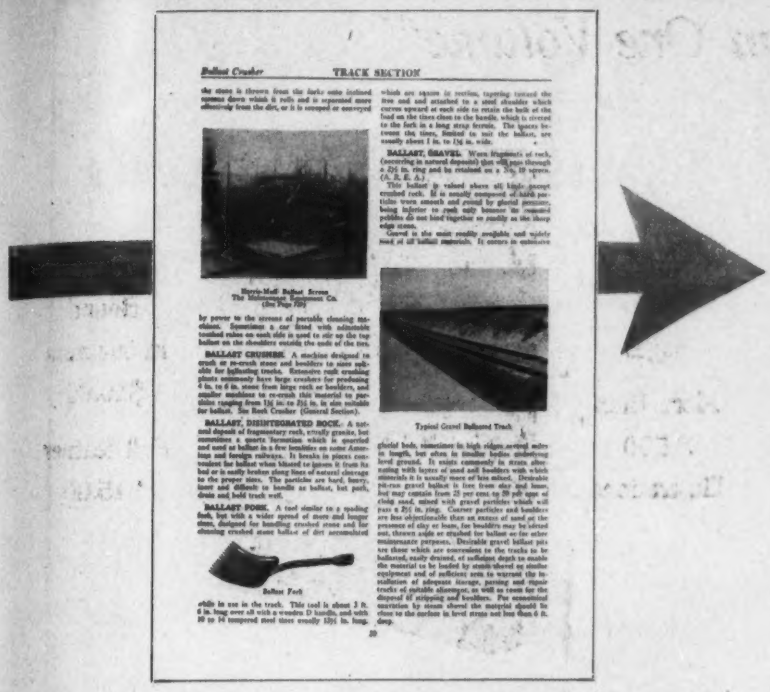
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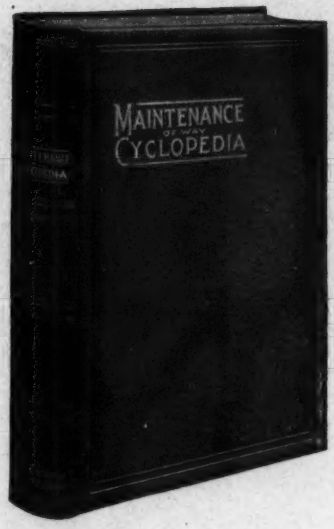

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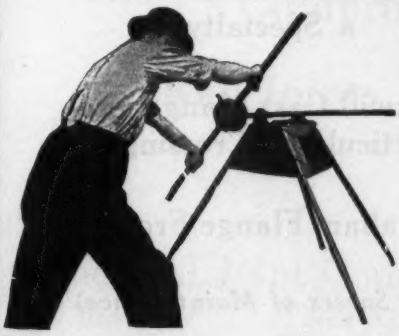

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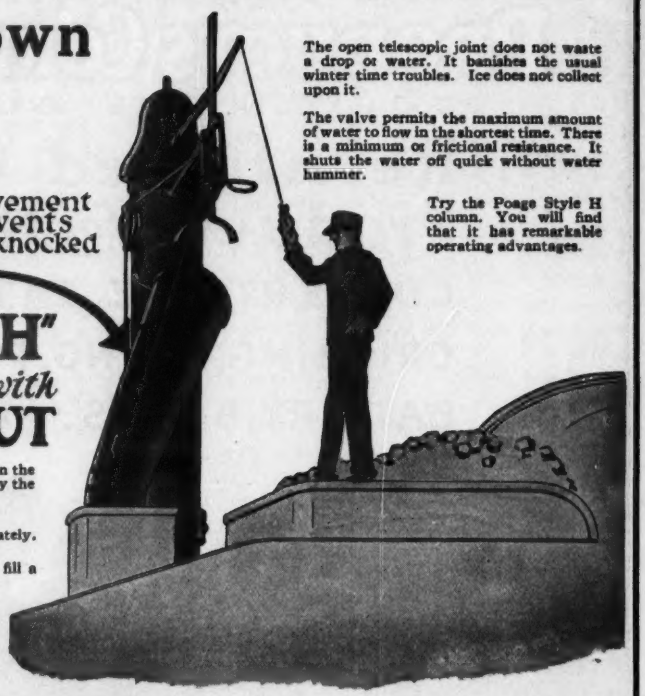

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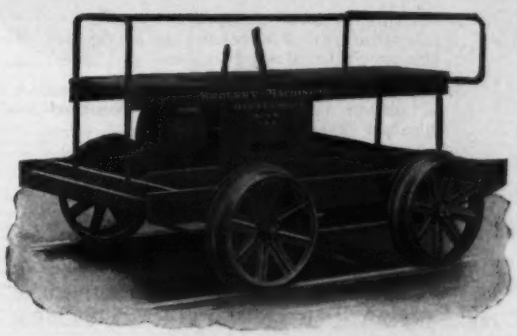


PATENT APPLIED FOR

12 Unexcelled Safety Features

Automobile Type Band Brake, Ideal for Cold Weather—It GRIPS regardless of rain, snow, sleet or frost.

No projections on side of car to trip workmen or catch on rails when removing from track.

Write Today for Descriptive Folder

WOOLERY MACHINE CO., Minneapolis, Minn.

Why Sullivan Air Lifts

will provide more and cooler water than can be secured from your wells by other methods, at lower cost per gallon for attendance, power and upkeep:

1. **Greatest volume for least power: The Sullivan Foot Piece contains a perforated tube, through which the compressed air is discharged in fine jets and mixed thoroughly with the water, thus securing maximum lifting effect.**
2. **No clogging: An opening, just below the mixing tube, permits sand or scale, lodging when pumping stops, to drop through and leave the perforations clear.**
3. **Can't wear out: The foot piece is made of heavy bronze, non-rustable.**
4. **Amount of air required can be varied automatically.**
5. **Sullivan Air Compressors supply compressed air for the system, economically and reliably.**

Get Bulletin 1971-G

SULLIVAN MACHINERY COMPANY

411 Gas Building, Chicago

What are the chief points of excellence in

American Water Softeners?

1. **Absolute accuracy of apportioning treating reagents to the flow of the water.**
2. **Settling tanks of a capacity to give the retention period necessary to settle out the precipitated solids.**
3. **Diameter of settling tanks such that rate of upflow is reduced to the point of greatest efficiency.**
4. **Carefully designed sludge removal system with backwash attachment, which assures the removal of sludge from settling tank with least possible waste of water.**

Simplicity of design and durability of construction combine with accuracy of treatment to make the AMERICAN WATER SOFTENER the superior of all others.

For this reason 25 American Railroads are using AMERICAN WATER SOFTENERS.

AMERICAN WATER SOFTENER COMPANY

Fairhill P. O. PHILADELPHIA, PA.

Specialists for twenty years in

Railroad Water Purification

Are You Going to *Get* Your Share?

During 1923, the principal railway improvement expenditures were for equipment. Roughly speaking, two-thirds of the total expenditures went for equipment and one-third for roadway and structures.

During 1924, present prospects indicate that these percentages may be reversed—at least to the extent that greatly increased expenditures will be made for additions and improvements to the tracks and structures.

THE REASON IS OBVIOUS

In 1923 the roads were confronted with what might easily have become an excess of traffic. Cars and motive power were the immediate necessity. Every dollar that could safely be so expended went for equipment. Construction and maintenance of way expenditures, while liberal, were secondary to equipment. Many improvements waited.

In 1924 a very heavy traffic will still be within the present enlarged equipment capacity of the roads to handle it. But it must be handled within narrower limits of expense per ton mile and per train mile. This means a greater proportionate expenditure for maintenance of way and roadway betterment. "Reduce Operating Costs" is the slogan for 1924.

A FEW PERTINENT FACTS

From budgets already prepared it is shown that one road is planning to expend $70,000,000 in improvements. Another has set aside $50,000,000, and two others have plans calling for $40,000,000 each; while the estimates of several roads call for expenditures of from $12,000,000 to $18,000,000. These are only a few of the larger items.

These plans include a large amount of second and other multiple track, the enlargement of terminal facilities, etc., which will require large tonnages of rails, joints, tie plates and other track accessories, as well as the tools and appliances for doing the work. Other improvements will require other materials and supplies in similar proportions.

This work comes within the field of

RAILWAY ENGINEERING AND MAINTENANCE

Its pages afford the medium through which to make known your products which will necessarily be in demand.

You cannot afford to miss the opportunity its advertising pages afford for engaging the attention of over 8,000 of the men who will authorize the supplies for this year's comprehensive program.

Ask us for further particulars

Railway Engineering and Maintenance

608 So. Dearborn St., Chicago.

Are You Going to *Do* Your Share?

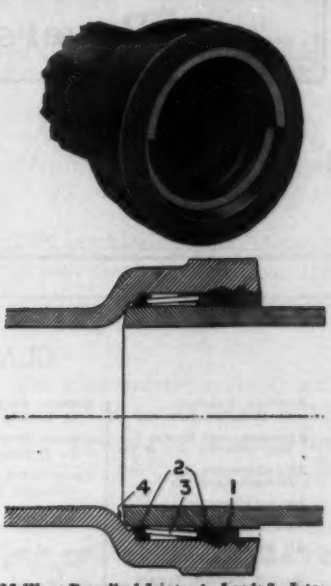
THIS JOB called for THIS PIPE

Genuine

McWANE PRECALKED JOINT PIPE CAST IRON

eliminates—

Bell holes,
Bottom-calking,
Lead-pouring,
Yarning,
Leaky Joints,
Rust,
Half the cost and
Two-thirds the time in joint-making.



McWane Precalked Joint. 1—Lead; 2—Jute; 3—Metal Wedges; 4—Shoulder of Pipe.

Sizes 1¼ to 6-inches. Standard Lengths. Get Booklet R.

McWANE CAST IRON PIPE CO., Birmingham, Ala.

PUMPS

A TYPE FOR EVERY SERVICE

Bulletins on request.

THE GOULDS MANUFACTURING COMPANY

SENECA FALLS, N. Y.

GOULDS

DIG

A Prominent Pittsburgh Contractor Says:

"With reference to a couple of Dreadnaught Buckets which we bought from you about a year and a half ago, we wish to say that one of these buckets has seen continuous service for at least seven months and during this time we have had no trouble and no repairs whatsoever.

We found that it will handle material which is hard to dig with an Orange Peel Bucket, at least twice as fast, thereby decreasing the cost for excavating such material. So far we have not found any material, except rock, which we could not dig with the bucket.

What we like in particular about the bucket is the fact that it does not have to be straightened out like an Orange Peel Bucket, which is the only bucket this Company used heretofore in extremely heavy digging.

We are very well pleased with the performance of this bucket and would recommend it to anybody."

Excavate with a Powerful DIGGING DREADNAUGHT

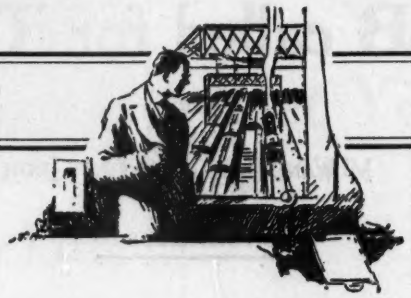
Chew off big bucket loads

The Blaw-Knox DREADNAUGHT has well shaped digging scoops—with tremendous lever arm power behind them for forcing through packed broken stone, bank gravel, clay and other hard packed materials—heaping up big loads in any material which can be "clammed" at all. Built by master builders to stand the gaff of hard continuous digging—a Blaw-Knox Dreadnaught Bucket *lasts*. *Rope wear* and *bucket wear* are reduced to a minimum.

BLAW-KNOX COMPANY
639 Farmer's Bank Bldg., Pittsburgh, Pa.

BLAW-KNOX BUCKETS

Buyers' Guide



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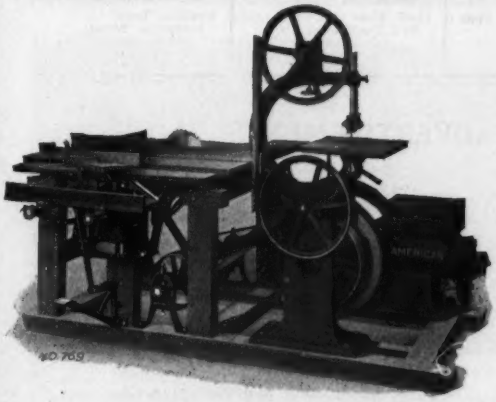
5,000 C. P.—10 Hours

You can treat it rough. Tip it over.
Roll it around. No harm done.

The Blake Manufacturing Co.
Mansfield, Pennsylvania

AMERICAN COST CUTTERS



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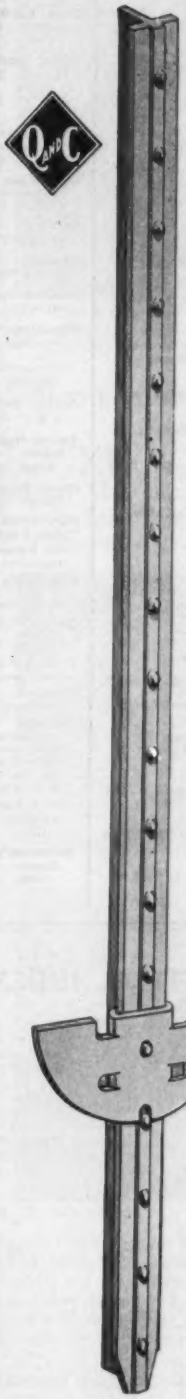
Variety Woodworkers,
Rip and Cut-off Saws, Saw Mills,
Timber Resaws, Planers.

American Saw Mill Machinery Co.
164 Main Street Hackettstown, N. J.

Built for Permanent Fencing



The Improved Q & C Studded Steel "T" Post

The permanency and strength of your fence depends upon the security of the anchor plate on the posts.

The improvement in the Q & C Century Steel "T" Post is in the new method of fastening the anchor to the post, as shown in the accompanying illustration. This method is a positive assurance against the post becoming loose in the ground and makes a much stronger and more rigid fence. These posts are made of a high grade carbon steel, coated with a liquid preparation, which eliminates corrosion. They are strong and rigid, lightning proof and rust proof, thus insuring long service and better fences.

Further information on request.

THE Q & C COMPANY
90 West Street New York
Chicago, San Francisco, St. Louis

The Improved Anchor

The Anchor that grips like a hand, found only in the new improved Century Steel Post, is a positive assurance against post becoming loose in the ground under any conditions.

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Q. & C. Co. 33

R
Rail Joint Co. 29
Ramapo Ajax Corp. 10
Reliance Manufacturing Co. 2

S
Selflock Nut & Bolt Co., Inc. 12
Sullivan Machinery Co. 30

V
Verona Tool Works 36

W
Western Wheeled Scraper Co. 21
Wharton, Jr., & Co., Wm. 29
Wood Shovel & Tool Co. 16
Woolery Machine Co. 29

THE IDOL TRACK LINER

Illustration No. 1

Showing the Liner in position against the rail in track. The liner is set at an angle to permit the farthest throw of the track. If the track must be moved more than 1¼ inches, the Liner should be reset for each throw.

Illustration No. 2

Showing the Idol Track Liner in use as a tie spacer.

Illustration No. 3

Showing the Idol Track Liner raising low joints.

Illustration No. 4

Showing Liner in position at tend of tie. Use Liner in this manner at switch points, or where spacer straps do not permit contact between the Liner and the base of the rail.

Now in Use on 48 Different Roads

Illustrations numbers 5 and 6 show the proper placement of Liners to line frogs. Place three Liners against outside rail in direction of throw, two Liners against frog and two Liners against inside rail. The work of lining can be done with one-third the number of men required when using lining bars. This work usually takes a greater period of time with 15 to 21 men using lining bars than is taken by 7 men when using Idol Track Liners.

Illustration No. 5

Illustration No. 6

Illustration No. 7

Illustration No. 8

Illustrations numbers 7 and 8 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration number 7 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 8 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

Watch for our advertisement in the March issue, showing diagram of proper frog and switch lining

IDOL TRACK LINER CO.

Thomas D. Crowley & Co., Gen'l Sales Agents

122 S. Michigan Ave., Chicago, Ill.

Like a man with a wrench at every joint

If you could post a man with a wrench at every joint in your track—

So that his sole duty would be to draw up the nuts that were loosened even infinitesimally thru wear, rust, or bolt stretching—

Your joint maintenance would be perfect.

That is precisely the effect of Verona Rail Joint Springs. They take up bolt looseness as fast as it occurs. They do away with the necessity for periodic tightening.

They make bolts tight, and despite wear, rust, or stretching, they keep them tight.

VERONA TOOL WORKS

Pittsburgh
St. Louis
New York
San Francisco
Washington
Chicago
New Orleans
Boston
Montreal